DOCUMENT RESUME

ED 452 122 SO 032 679

AUTHOR	Abbey, Cherie D., Ed.
TITLE	Biography Today: Profiles of People of Interest to Young Readers. Scientists & Inventors Series, Volume 5.
ISBN	ISBN-0-7808-0434-1
PUB DATE	2001-00-00
NOTE	220p.; For related volumes see ED 448 069, ED 446 066, ED 446 012, ED 446 011, ED 446 010, ED 427 000, ED 434 064, ED 439 044, ED 439 032, ED 439 031, ED 390 725, ED 380 367, ED 363 546, ED 351 257, ED 089 904, ED 423 192, and ED 422 217.
AVAILABLE FROM	Omnigraphics, Inc., 615 Griswold Street, Detroit, MI 48226. Tel: 800-234-1340 (Toll Free); Web site: http://www.omnigraphics.com/.
PUB TYPE	Books (010) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC09 Plus Postage.
DESCRIPTORS	*Biographies; *Computers; Individual Characteristics; Intermediate Grades; Inventions; Life Events; *Profiles; Readability; *Scientists; Secondary Education
IDENTIFIERS	*Biodata; *Inventors

ABSTRACT

This book, a special volume focusing on computer-related scientists and inventors, provides 12 biographical profiles of interest to readers ages 9 and above. The Biography Today series was created to appeal to young readers in a format they can enjoy reading and readily understand. Each entry provides at least one picture of the individual profiled, and bold-faced rubrics lead the reader to information on birth, youth, early memories, education, first jobs, marriage and family, career highlights, memorable experiences, hobbies, and honors and awards. Each entry ends with a list of easily accessible sources designed to guide the student to further reading on the individual. These profiles of computer-related scientists and inventors range from pioneers to recent achievers, from the business world to video games. The following scientists and inventors are profiled: Steve Case; Douglas Engelbart; Shawn Fanning; Sarah Flannery; Bill Gates; Laura Groppe; Grace Murray Hopper; Steven Jobs; Rand Miller; Robyn Miller; Shigeru Miyamoto; and Steve Wozniak. Contains a cumulative index, a general index, a places of birth index, and a birthday index. (BT)

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Biography Today: Profiles of People of Interest to Young Readers. Scientists and Inventors Series, Volume 5.

Abbey, Cherie D., Ed.

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Vol. 5

Biography Today

Profiles of People of Interest to Young Readers

Scientists & Inventors Series

Technology innovators featured in this issue . . .

Steve Case
Douglas Engelbart
Sarah Flannery
Bill Gates
Grace Murray Hopper
Steven Jobs
Rand and Robyn Miller
Shigeru Miyamoto

Shawn Fanning
Laura Groppe
Steve Wozniak
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Biography Today

Profiles of People of Interest to Young Readers

Scientists & Inventors Series

Volume 5

Cherie D. Abbey
Editor

Omnigraphics

615 Griswold Street • Detroit, Michigan 48226

Cherie D. Abbey, *Editor*
Kevin Hillstrom and Laurie Hillstrom, *Sketch Writers*
Joan Margeson and Barry Puckett, *Research Associates*

Omnigraphics, Inc.

* * *

Peter E. Ruffner, *Senior Vice President*
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ISBN 0-7808-0434-1

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Printed in the United States

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Preface

Welcome to the fifth volume of the **Biography Today Scientists and Inventors Series**. We began publishing this series in response to the growing number of suggestions from our readers, who wanted more coverage of more people in *Biography Today*. Several volumes, covering **Artists, Authors, Scientists and Inventors, Sports Figures, and World Leaders,** have appeared thus far in the Subject Series. Each of these hardcover volumes is 200 pages in length and covers approximately 12 individuals of interest to readers ages 9 and above. The length and format of the entries is like those found in the regular issues of *Biography Today*, but there is **no duplication** between the regular series and the special subject volumes.

Volume 5 Devoted to Technology Innovators

This is a special volume in our **Biography Today Scientists and Inventors Series**, which focuses on computer-related scientists and inventors. Each of the individuals profiled here is an innovator in the field of technology. Some were pioneers in the computer field from earlier days, as in Grace Murray Hopper, a Navy admiral who was one of the creators of the COBOL programming language, and Douglas Engelbart, whose accomplishments include the invention of the computer mouse, the windows environment, and hypertext. Some are more recent achievers, including Shawn Fanning, the creator of the Napster software used to share music files online, and Sarah Flannery, who devised a new cryptography system to encode information sent on the Internet. Some are creators of the computer and video games that we love, including Rand and Robyn Miller, who created the computer games *Myst* and *Riven*, and Shigeru Miyamoto, a noted Nintendo game designer who has created some of the most famous video games around, including *Donkey Kong, Super Mario Brothers,* and *Zelda*. Others are known for their technological accomplishments in the business world, including Steve Case, the co-founder of the popular Internet service provider AOL, and Laura Groppe, who as founder of Girl Games has produced software that encourages technology use by teenage girls.

This volume also includes profiles devoted to Bill Gates and Steven Jobs, both of whom were originally featured in earlier volumes of *Biography Today* (1993 and 1992, respectively). Yet Gates and Jobs have been so important to the industry that a computer-related book wouldn't be complete without them. So much has happened for each of them in the intervening years, since our original profiles, that we decided to include Updates on these two seminal figures in this volume. These Updates give a brief history of their early accomplishments and then focus on their recent achievements and their plans for the future.

The Plan of the Work

As with the regular issues of *Biography Today*, this special subject volume on **Scientists and Inventors** was especially created to appeal to young readers in a format they can enjoy reading and readily understand. Each volume contains alphabetically arranged sketches. Each entry provides at least one picture of the individual profiled, and bold-faced rubrics lead the reader to information on birth, youth, early memories, education, first jobs, marriage and family, career highlights, memorable experiences, hobbies, and honors and awards. Each of the entries ends with a list of easily accessible sources designed to lead the student to further reading on the individual and a current address. Retrospective entries are also included, written to provide a perspective on the individual's entire career. Retrospectives are clearly marked in both the table of contents and at the beginning of the entry.

Biographies are prepared by Omnigraphics editors after extensive research, utilizing the most current materials available. Those sources that are generally available to students appear in the list of further reading at the end of the sketch.

Indexes

A new index now appears in all *Biography Today* publications. In an effort to make the index easier to use, we have combined the **Name** and **General Index** into one, called the **General Index**. This new index contains the names of all individuals who have appeared in *Biography Today* since the series began. The names appear in bold faced type, followed by the issue in which they appeared. The General Index also contains the occupations and ethnic and minority origins of individuals profiled. The General Index is cumulative, including references to all individuals who have appeared in the *Biography Today* General Series and the *Biography Today* Special Subject volumes since the series began in 1992.

The Birthday Index and Places of Birth Index will continue to appear in all Special Subject volumes.

Our Advisors

This series was reviewed by an Advisory Board comprised of librarians, children's literature specialists, and reading instructors so that we could make sure that the concept of this publication — to provide a readable and accessible biographical magazine for young readers — was on target. They evaluated the title as it developed, and their suggestions have proved invaluable. Any errors, however, are ours alone. We'd like to list the Advisory Board members, and to thank them for their efforts.

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Our Advisory Board stressed to us that we should not shy away from controversial or unconventional people in our profiles, and we have tried to follow their advice. The Advisory Board also mentioned that the sketches might be useful in reluctant reader and adult literacy programs, and we would value any comments librarians might have about the suitability of our magazine for those purposes.

Your Comments Are Welcome

Our goal is to be accurate and up-to-date, to give young readers information they can learn from and enjoy. Now we want to know what you think. Take a look at this issue of *Biography Today*, on approval. Write or call me with your comments. We want to provide an excellent source of biographical information for young people. Let us know how you think we're doing.

Cherie D. Abbey
Editor, *Biography Today*
Omnigraphics, Inc.
615 Griswold Street
Detroit, MI 48226
Fax: 1-800-875-1340

Steve Case 1958-

American Internet Entrepreneur
Co-Founder, Chairman, and Chief Executive Officer
of America Online (AOL)

BIRTH

Stephen McConnell Case was born on August 25, 1958, in Honolulu, Hawaii. His father, Dan Case Jr., is a senior partner at a Honolulu law firm. His mother, Carol Case, is a teacher at an elementary school. The Cases thought that they could not have children, so they applied to adopt a baby girl. By the time the adoption was approved, however, Carol was four months pregnant with their son Dan. Steve's adopted sister, Carin, is the same age as his older brother. Steve was born 13 months later. The family also includes another brother, Jeff, who is four years younger than Steve.

YOUTH

Steve Case grew up in the Makiki Heights neighborhood of Honolulu, sharing a bedroom with Dan. The two boys became very competitive and often played games and held contests to see who would get stuck with chores, like doing yard work or dishes. "The dishes weren't a big deal, because they only take ten minutes," Steve recalled. "Losing was."

In spite of their competition, the boys were very close and often came up with ideas to make money. Steve sometimes woke up Dan in the middle of the night to tell him about a new business scheme. Usually Steve handled the marketing and Dan took care of the money and other details. Calling themselves Case Enterprises, they sold juice made from the limes in their backyard, went door to door selling seeds, and even got the exclusive rights to sell a certain brand of Swiss watch. Unfortunately, nobody wanted to buy the watches. They also formed a direct-mail operation to sell magazines and greeting cards.

In high school, Case wrote record reviews for the school newspaper. Calling himself the reviewer for the largest student newspaper in Hawaii, he sent letters to several small record companies asking for free albums. Although Case's claim was technically true, he managed to make his position seem more important than it really was. Still, the small record companies sent him free albums. He wrote reviews, always praising the albums, then sent samples of his reviews to the major record labels. These record companies responded by sending him more free albums, as well as free concert tickets. As his brother Dan put it, "He promotes the story, always in a way that's accurate but projecting a little."

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EDUCATION

Case deliberately tried to avoid competing with his brother at Punahou School, a private college-preparatory high school. Dan was an "A" student who excelled at everything he did, while Steve was satisfied with "Bs." "He was a bright enough kid," recalled his father, "but getting the 'A' wasn't crucial. He wouldn't bust the gut." Both boys loved tennis, but because Dan played tennis at school, Steve went out for basketball so he would not have to play against his brother in tournaments. Dan decided to go to Princeton University in New Jersey, so Steve chose to attend his father's alma mater, Williams College in Williamstown, Massachusetts.

At Williams College, Case majored in political science. "It was the closest thing to marketing," he explained. He joined the All Campus Entertainment Committee, which arranged for band concerts on campus. Although Case claimed that he had "rather limited singing talent," he was the lead singer in two groups. One of them was a spoof of The Cars, while the other was inspired by the new wave group The Knack. He also managed to run a money-making airport shuttle business while in college.

Surprisingly, Case hated the one computer class he took in college. "It was the punch card age," he recalled, referring to the way that early computers read their programming instructions from holes punched in paper cards. "Waiting an hour to have the cards run to see if the program worked didn't have much appeal." Still, he was fascinated by the idea that the college's computers could be connected to other computers in remote locations via telephone lines. "The faraway connections seemed magical," he noted. "It struck me as the most completely obvious use for them, and the rest was just for computer wonks." Case graduated from Williams College in 1980 with a B average and a bachelor of arts (B.A.) degree in political science.

CAREER HIGHLIGHTS

Hair Conditioners and Pizza Toppings

Case's first job was in the marketing division of the huge consumer products company Proctor & Gamble. As an assistant brand manager, he tried to sell a product called Abound, which was a hair conditioner that was applied by wiping it on with a towelette. "Towelette? You Bet!" was the slogan. "It was a disaster," Case later recalled. But the experience taught him a valuable lesson: that good marketing cannot save a bad product. He enjoyed working at Proctor & Gamble, and two years went by before he was ready to move on. "He loved the company, but they were so big," his younger brother Jeff remembered. "He had lots of ideas and wanted to move faster."

Case then took a job in the corporate offices of Pizza Hut, based in Wichita, Kansas. He was put in charge of "pizza development," which involved flying around the county to sample pizzas at local restaurants, looking for new ideas for toppings. In each city, he checked in at a good hotel, then went out into the neighborhoods to dine at the local "dives," or tiny eateries that usually had the most interesting pizzas. He experimented with stuffed and folded slices. One of his topping discoveries that caught on was pineapple. But driving rental cars and spending night after night in hotels eventually became boring. As Case was not yet married, the nights he spent in his small condominium in Wichita were lonely as well.

It was during his time with Pizza Hut, in the early 1980s, that Case bought his first personal computer—a bulky Kaypro—and a modem. He continued to be fascinated with the idea of connecting computers through telephone lines, allowing computer users from around the world to communicate with each other. He struggled for weeks to configure his computer to connect with other computers online via the Internet. Though getting a dial-up connection was difficult, he finally managed to log on to an early online service called The Source. He soon found that being online gave him an escape from his isolation. "It was like climbing Mt. Everest, and I think my first thought was to wonder why it had to be so hard to work it," he recalled. "But when I finally logged in and found myself linked to people all over the country from this sorry little apartment in Wichita, it was just exhilarating."

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> *Case struggled for weeks to configure his computer for his first online connection. "It was like climbing Mt. Everest, and I think my first thought was to wonder why it had to be so hard to work it," he recalled. "But when I finally logged in and found myself linked to people all over the country from this sorry little apartment in Wichita, it was just exhilarating."*
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The clunky nature of the system made Case realize both what was possible and what needed to be done. He began to look for opportunities at companies involved in linking computers to telecommunications. "By day I was focused on Pizza Hut, but my passion was learning about this online world by night," he remembered.

Case helping a student at Broad Run High School in Virginia, September 2000, as part of a partnership between AOL and Virginia schools to expand and improve students' Internet use.

Control Video Corporation

Dan Case knew that Steve was bored with his job, so he began sending his brother plans for new business ventures. Dan was a venture capitalist who worked for Hambrecht & Quist, a company that invested in promising new businesses. One of the businesses they were interested in was Control Video Corporation (CVC). CVC charged its customers a dollar to download a video game into their computers for one use. It was a "pay-per-play" arrangement, somewhat like today's pay-per-view cable television shows. Dan introduced Steve to Bill Von Meister, CVC's founder, and Steve soon accepted a job with the company as a marketing consultant. Unfortunately, the timing of Case's job change was not good. Video games, which had exploded on the scene a few years earlier, were fast fading in popularity by 1983. "I arrived there just in time for the death of the video game business," Steve acknowledged.

Shortly after Case joined CVC, the company's board fired Von Meister and most of the 50-person staff. Partly because of his rare position as a market specialist, and partly because of his brother's connection to Hambrecht &

Quist, Steve Case remained on the job to devise a new marketing strategy for the struggling company. For a while his brother worked with him, and Dan and Steve were known as Upper Case and Lower Case. In 1984, however, Dan Case ended his involvement with CVC to avoid any concern over a conflict of interest. Several people in the company wanted the aggressive 25-year-old Steve Case to leave the company, too. But his job was saved because he won the support of Jim Kimsey, the new chief executive. Kimsey felt that Case was the only one in the company who had any knowledge of the online marketplace.

Case firmly believed that computers with online connections would become an important part of many people's lives in the future. As a user who was not a technology person, he was able to see the problems as well as the magic of the shared online experience. He made it a personal mission to sell the experience to the general public.

"

In apologizing to AOL users for system overloads, Case said, "I would like to be able to tell you that this sort of thing will never happen again, but frankly, I can't make that commitment."

"

Quantum Computer Services

Control Video Corporation changed its name to Quantum Computer Services in 1985. At the time, the company provided services only for the Commodore brand of personal computer. Quantum's online service, called Q-Link, offered content such as games, electronic mail, and updates of news and soap operas to Commodore users. Every week, Case drove to Commodore's headquarters to make himself available for questions and make sure the relationship between the two companies was solid.

The following year, Case moved to Cupertino, California, so he could be near the headquarters of Apple Computer. For three months, he visited Apple each day, trying to reach an agreement that would let Quantum develop an online service for Apple. Finally, his persistence paid off. He was awarded a contract to develop software for the Apple II and Macintosh personal computers. A short time later, Tandy Corporation reached a similar agreement with Quantum. The Windows operating system was becoming increasingly popular, so Quantum developed an online software package for Windows as well as the DOS operating system that was still found on many computers.

WORLD ECONOMIC FORUM
GATES III
REDS

Case with Bill Gates at the World Economic Forum in Davos, Switzerland, January 2000.

In 1989, Quantum's management decided to combine all of the company's separate services into a single online service available to all users, regardless of what brand of personal computer they owned. The service was called America Online (AOL). Two years later, Quantum Computer Services changed its name to America Online, Inc. Case became chief executive officer of the young company, with Kimsey remaining as chairman.

The Growth of America Online

In the early 1990s, more and more people bought personal computers. Case believed that the next step for many users would be to connect to other users through the Internet. He was convinced that the first companies to offer easy-to-use, interesting, online information and electronic mail services would have a big advantage in attracting these computer users. With this in mind, he developed a direct marketing campaign that involved mailing thousands of AOL software diskettes to potential subscribers. The disks were also placed in computer magazines and other publications. Not only did these disks make it easy to connect and subscribe to AOL, they also offered several hours of free use of various online services.

Case speaking with President Clinton in February 2000.

At the same time, Case began making agreements with top newspapers, magazines, and financial services companies in order to expand the content offered by AOL. Before long, people could use AOL to read the latest articles in the *New York Times* or *Time* magazine, or to get news and program information from the NBC television network, or to receive financial information from Morningstar analysts. They could also use the electronic mail feature to communicate with other AOL members who shared their interests, around the country or around the world. To make the service even more attractive, the company cut prices well below the competition in early 1993.

People who had already been using online services criticized Case's marketing tactic of mailing diskettes as cheesy commercialism. These people were dismayed at all the "newbies," or beginners, who were using AOL to enter online "chat rooms" without knowing the proper "online etiquette." But for America Online, growth exceeded all expectations. Every month or two, the company added another 100,000 subscribers. It did not take long before this huge number of users began to overwhelm AOL's systems. People would suddenly get disconnected from their service, and it sometimes took an hour to sign back on. Messages would take several minutes to reach a chat room. Complaints about AOL's online service began to pile up.

Improving Service

In early 1994, Case sent a letter of apology to all AOL users. He promised to improve the service quickly, and he kept his word. That year Case split America Online into four divisions—international, technology, basic services, and Internet services. He bought Advanced Network Services (ANS), a developer of the Internet network, which gave AOL high-speed capability so users could communicate faster. He also purchased Redgate Communications, which had expertise in multimedia (the use of audio, video, and text at the same time).

Later in 1994, Case entered into partnerships with several cable companies, including Comcast, Viacom, and General Instrument. "[This] will allow us to offer our customers much more engaging, multimedia-rich kinds of services," he explained. By 1995, America Online had more than three million subscribers. In addition to his title of chief executive officer, Case was elected chairman in late 1995. By the end of that year, AOL had boosted its membership to five million subscribers.

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> *In announcing AOL's plan to merge with Time Warner, Case said that "We're trying to usher in the whole next age of the Internet. I think it's going to be a profound event. I think there will be other profound events in the years ahead. . . .Together we have an unbelievable opportunity to really make a difference, not just in terms of the services people use, but also in terms of the kind of impact we can have on society."*
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In 1996, Case made some major strategic moves to expand AOL even further. The company's browser (a graphical interface that helps users move around the World Wide Web) was much less popular than industry leaders Netscape Navigator and Microsoft Internet Explorer. Case made deals with both Netscape and Microsoft to make their browsers available to AOL users. AOL added the Explorer browser into its online software, and in turn, Microsoft included AOL in its Windows 95 operating system. The Netscape browser was used in AOL's Global Network Navigator service, a service for sophisticated Internet users.

An even bigger change for users was a new flat rate introduced in 1996. In earlier years, AOL subscribers had been given a choice of monthly plans in which they paid a certain amount for a set number of hours, then paid extra for each additional hour over that number. The new rate was $19.95 per month, with no limit on the number of hours users could spend online. This change brought in a large number of new subscribers. But once again, the increase in subscribers overwhelmed AOL's systems and people had problems getting connected. The problems became so bad that wisecracking critics called the company "America On Hold." To make matters worse, on August 7, 1996, a maintenance problem caused the company's service to be out of order for 19 hours. This time, a letter of apology was not enough. AOL offered refunds to people who could not connect because of system overload. In apologizing to users, Case said, "I would like to be able to tell you that this sort of thing will never happen again, but frankly, I can't make that commitment."

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> *Back in the days of clunky computers and text-only computer screens, no one realized the potential of the Internet, Case says. "People thought it was sort of this hobby, [a] computer nerd sort of thing. But we had a belief then, and we have a belief now, that over time what would happen was the development of a new medium, which would . . . be as important as radio was, or television."*
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Expanding for the Future

By 1997 America Online had ironed out most of its technical problems. The company also continued to grow, purchasing the CompuServe online service and Netscape, the company that produced the popular Navigator browser. AOL also hired Netscape's founder, Marc Andreessen, as its chief technology officer. AOL then bought MovieFone, which let users check local movie listings and buy tickets online. By 2000, AOL boasted 23 million subscribers. On typical weekday evenings during prime time, more than one million people were connected to AOL.

For many users, AOL was seen as a way to stay connected to a larger community, and especially to friends. Some key features of AOL's popularity have been its email, instant messaging, buddy lists, and chat rooms. Email on AOL has proved to be an easy way to keep in touch with friends, and the ubiquitous slogan "You've got mail!" is a welcome greeting when log-

Steve
Case
Gerald
Levin

Case and Time Warner Chairman Gerald Levin (right), testifying before the Federal Communications Commission in Washington, D.C., on the merger of AOL and Time Warner, July 2000.

ging on. The first widely used instant messaging service was created by AOL, and instant messaging has become successful because it allows for fast and casual online conversations. The buddy list was also created by AOL, allowing users to keep track of which friends are available online at all times. And chat rooms, hosted by AOL, bring together people with common interests. These features, which have made chatting on the computer a daily activity for many, have further solidified AOL's appeal to its users, especially to its teen customers. According to Barry Schuler, an AOL executive, "People come to AOL because that is where their friends are."

In January 2000, America Online announced that it was planning to make one of the hugest business deals in history. Case announced that his company intended to merge with Time Warner, a $1.56-billion dollar company that owns a huge variety of familiar mass media brands. "We didn't buy Time Warner," Case explained. "It was a merger of equals." The merger was approved by the U.S. government in January 2001. It has connected AOL with such popular creations as Bugs Bunny cartoons, HBO, *People* magazine, the Book of the Month Club, and CNN. It has also given AOL access to millions of homes that are connected to Time Warner's cable services. "We're trying to usher in the whole next age of the Internet," Case claimed. "I think it's going to be a profound event. I think there will be other profound events in the years ahead. . . .Together we have an unbelievable opportunity to really make a difference, not just in terms of the services people use, but also in terms of the kind of impact we can have on society."

Case believes that the merger will help fulfill his early vision of giving people access to a wide variety of information and services online. He points out that back in the days of clunky computers and text-only computer screens, no one realized the potential of the Internet. "People thought it was sort of this hobby, [a] computer nerd sort of thing," he said. "But we had a belief then, and we have a belief now, that over time what would happen was the development of a new medium, which would . . . be as important as radio was, or television."

> *Case has been described as a shy, calm, and private person. But he says, "I'm not as introverted as people think. . . . I like the fact that I might go to the White House or be on the* Today *show but then go with my kids to a movie at the shopping center and for the most part be unrecognized. The ability to lead a normal life is what I'm trying to preserve."*

Today, Steve Case is recognized as one of the early visionaries who pioneered the growth of online services and helped make the Internet accessible to ordinary people across the United States and around the world. His innovative marketing strategies —including mailing software diskettes to potential subscribers, offering free trials of his online service, introducing standard membership fees, developing a user-friendly graphical interface, creating messaging services, and providing popular content—have helped AOL become the dominant force in the online service industry.

MARRIAGE AND FAMILY

Steve Case has been married twice. He married his college girlfriend, Joanne Barker, in 1985. The couple had three children together before they divorced in 1996. Two years later, Case married Jean Villaneuva, AOL's former chief communications officer. They had a private ceremony performed by Case's friend, the Reverend Billy Graham, whom he had met online. With children from previous marriages, there are now five children in the family.

HOBBIES AND OTHER INTERESTS

Steve and Jean Case together administer the Case Foundation. Created in 1997, the foundation has an endowment of $150 million to help low-income young people obtain Internet access. The foundation provides teams of educators and community leaders with "seed money" to develop ways to improve student performance through integration of interactive technology. It has also joined with the Benton Foundation and the National Urban League to create the National Digital Divide Clearinghouse. The "digital divide" refers to the gap in computer use between whites and ethnic minorities. Case has also donated another $30 million to churches, schools, and other causes.

In his spare time Case reads books on political science and social history. He likes to talk about his children, Little League, and the PTA. Whether at home or work, however, he is most comfortable in front of his computer. He has been described as a shy, calm, and private person. But he says, "I'm not as introverted as people think. . . . I like the fact that I might go to the White House or be on the *Today* show but then go with my kids to a movie at the shopping center and for the most part be unrecognized. The ability to lead a normal life is what I'm trying to preserve."

HONORS AND AWARDS

Entrepreneur of the Year (*Inc.* magazine): 1994
American Horizon Award (Media Institute): 1998
Kellogg Award for Extraordinary Career Achievement (Williams College): 2000
Morgan Stanley Dean Witter Leadership Award for Global Commerce (Computer Smithsonian Program): 2000

FURTHER READING

Books

Encyclopedia of World Biography, 1999
Swisher, Kara. *AOL.com: How Steve Case Beat Bill Gates, Nailed the Netheads, and Made Millions in the War for the Web*, 1999
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Newsweek, Jan. 24, 2000, p.30
People, Dec. 25, 2000; p.70
Time, Sep. 22, 1997, p.46; Jan. 24, 2000, p.46
U.S. News & World Report, Jan. 24, 2000, p.41
USA Today, Jan 12, 2000, p.B3
Wall Street Journal, Jan. 11, 2000, p.B1
Washington Post, Aug. 27, 1995, p.A1; Nov. 25, 1998, p.C1; Jan. 11, 2000, pp.A1, A6; Jan. 16, 2000, p.A1; June 4, 2000, p.A1

ADDRESS

America Online, Inc.
22000 AOL Way
Dulles, VA 20166

WORLD WIDE WEB SITES

http://stevecase.aol.com
http://corp.aol.com

Douglas Engelbart 1925-

American Computer Scientist and Electrical Engineer
Inventor of the Computer Mouse, the Windows Environment, and Hypertext

BIRTH

Douglas Engelbart was born on January 30, 1925, in Portland, Oregon.

YOUTH AND EDUCATION

Engelbart is a very private person, so little is known about his childhood and early education. He has revealed that his grand-parents were among the early pioneers to move to the American West, settling in Oregon. Engelbart grew up on a small family farm near Portland. He graduated from high school in 1942 and then attended Oregon State University (OSU), where he majored in electrical engineering. In 1946, Engelbart set aside his studies and joined the U.S. Navy during World War II. He served for two years as a radar technician in the Philippines.

When he returned to Oregon, Engelbart completed his bachelor's degree at OSU, graduating in 1948. He then joined the work force for several years. But he returned to school in 1951, completing his master's degree in electrical engineering at the University of California at Berkeley the following year. He then moved on to Berkeley's doctorate program, from which he received his Ph.D. in electrical engineering in 1955.

> *Engelbart's first job was at the National Aeronautics and Space Administration (NASA) Ames Laboratory in California. "Nice people, nice place, secure job, but just no events. It was just unclear to me what kind of goals I was after professionally, and it was just humiliating to think I didn't have anything other than a pleasant, steady job. But I grew up in the Depression, when this was almost every kid's thing: get a steady job."*

CAREER HIGHLIGHTS

Innovations Changed the Computer Industry

When asked to sum up his 50-year career in the computer industry, Engelbart once said that his main goal was "to help mankind get collectively better able to cope with complex, urgent problems." One look at Engelbart's list of inventions and innovations confirms that he has achieved his goal. His most famous invention — the computer mouse that enables computer users to point at and click on items on their monitors — is found in most homes and businesses today. Engelbart is also credited with being one of the earliest developers of the worldwide computer network known as the Internet.

In addition, Engelbart is widely recognized as the man who invented hypertext. Hypertext is the system used to link together documents and sites on the World Wide Web, or in any other computer environment. Using computer codes, hypertext gives a piece of information a distinct "address" and lets a user access that information by pointing at words on a computer screen and clicking on them. Thanks to hypertext, this simple action transports the user to a new document or location on the Web that is designated by that "address." Hypertext links in one document can lead to new links in another document, which can lead in turn to more new links. In this way, the links provide multiple ways to access information and group pieces of information together. Creating such links allows computer users to store and access vast amounts of information in practical ways. Hypermedia, which Engelbart is also credited with creating, takes hypertext one step further by allowing links to sound, image, and video, in addition to text.

Amazingly, Engelbart has contributed to a number of other well-known innovations as well. For example, he helped develop computer video conferencing, which allows people at different locations to use video signals transmitted over computer networks to see and hear each other. He also came up with the earliest concept of computer "windows," which allow computer users to keep multiple software programs or documents open on their computer screens at the same time. Engelbart also created groupware, which allows computers to be arranged in a network so that they can share computer software that is stored on just one computer. Finally, he is credited with inventing the idea of hypermedia publishing, which refers to online publishing that includes sounds, images, and video.

Developing an Interest in Computers

Engelbart's interest in computers developed while he was serving in the Navy in the 1940s. At that time, computers were huge, bulky machines that could only be used by trained professionals. As a radar technician, Engelbart saw that cathode ray tubes (which are used for radar screens) could be used to display information, and he wondered if the same type of screen could display images and text that were input into a computer. When he returned to the United States and finished his degree at OSU, Engelbart decided to put that interest in computers to work.

His first job was at the National Aeronautics and Space Administration (NASA) Ames Laboratory in Mountain View, California, where he worked as an electrical engineer from 1948 to 1951. Engelbart was pleased to have his job at Ames, but it did not really excite him. "Nice people, nice place, secure job, but just no events," he recalled. "It was just unclear to me what kind of goals I was after professionally, and it was just humiliating to think I didn't have anything other than a pleasant, steady job. But I grew up in the Depression, when this was almost every kid's thing: get a steady job."

Engelbart's dissatisfaction with his job increased in 1950, when he married his wife, Ballard. His marriage made him take stock of his life and conclude that he should be doing more with his talents. After a great deal of thought, he determined that his overall goal was to help mankind deal with complex problems. But then he took this idea a step further. Engelbart decided that he did not want to work all his life to try to solve one problem. Instead, he wanted to try to change the approach people took to solving *all* problems. Although his goal might have seemed overly ambitious to some people, Engelbart believed in himself and his ability to tackle such a huge undertaking.

Deciding to Use Computers to Solve People's Problems

Based on his experiences with radar screens and his engineering background, Engelbart was convinced that finding new ways to solve the world's problems would definitely involve computers, which were still in the earliest stages of development at that time. To begin his life's work, Engelbart first went back to school to earn his master's and doctorate degrees at the University of California at Berkeley. After completing his degrees in 1955, Engelbart took a teaching position at Cal-Berkeley. He worked as an assistant professor in the electrical engineering department from 1955 to 1956.

In 1957, Engelbart moved to the Stanford Research Institute (now SRI International) at Stanford University. It was there, during a distinguished 20-year stay, that he would make most of his important discoveries regarding computers and shared knowledge. Just two years after he started at SRI as a researcher, he was named director of the Augmentation Research Center (ARC), which was part of the research institute. To fund his research, Engelbart obtained a small government grant. At the peak of the ARC's activity, Engelbart had more than 45 people working with him.

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> *Here, Engelbart describes the first mouse. "[It is] palm-filling size, has a flexible cord, and is operated by moving it over a suitable hard surface that has no other function than to generate the proper mixture of rolling and sliding motions. It stays put when your hand leaves it to do something else (type or move a paper) and re-accessing proves quick and free from fumbling. Also, it allows you to shift your posture easily, which is important during long work sessions."*
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> "

Engelbart at home with the first computer mouse he invented and his white mouse.

In his early years at ARC, Engelbart met with resistance from more traditional scientists who thought he was an impractical dreamer. "I had . . . almost nothing but negative reaction from people [before working at SRI] and for several years here, too," he wrote in a 1962 letter to noted scientist

Vannevar Bush. Engelbart was inspired by Bush's writings and considered him a mentor. Engelbart hoped that his ideas would gain more recognition with the publication of his first paper. But when "A Conceptual Framework for the Augmentation of Man's Intellect" was released in 1963, it was almost ignored. In fact, only one scientific journal even bothered to review it.

Today, however, Engelbart's paper is seen as evidence of his incredible ability to forecast the shape of modern computing. For example, he spoke of a world in which people had computers at their desks through which they could share information back and forth. He envisioned people instantly writing new documents, and then changing those documents whenever they liked and as extensively as they liked. In essence, he described today's networks of personal computers and word processing software. Although Engelbart was discouraged by the lack of reaction to his article, he pressed on with his research.

Creating the Windows Environment and the Computer Mouse

The next focus of Engelbart's research was the computer screen itself. Engelbart felt that there was no reason the user should be limited to viewing just one thing on the screen at a time. He wanted users to be able to look into different "windows" at the same time, and to be able to move back and forth between those windows. Today, when thinking of windows, most computer users think of the Microsoft system that operates their computer. But Microsoft didn't create the term "Windows"; they simply adapted the name. "Windows" really refers to the technique of putting multiple views of different information or software on one computer screen, a technique that Engelbart invented.

Once he had developed the windows concept, Engelbart knew he needed a device to access the multiple views—using the keyboard was too awkward. That need led to his best-known invention, the computer mouse. While the computer mouse seems to be a simple and obvious design, it took many attempts before Engelbart settled on the final version. Before he picked what we know as a "mouse," Engelbart tried every other kind of device for pointing and manipulating objects on a screen, such as light pens and joysticks. The strangest device he tried was a type of steering wheel that was activated by the user's knee. But he rejected all of these devices. The one idea that stuck in his head was a wheeled instrument he had used to measure surface area on engineering diagrams while in college. "That just flashed in my mind when I was sitting in a meeting one time, being bored and getting my notebook out and thinking thoughts," he remembered.

Before Engelbart came up with the final design, there was no intent to give it a catchy or clever name. But when members of Engelbart's design team saw the first working device, someone declared tnat it was about the size of a mouse and that it even looked like one, with the cord trailing behind it like a tail. Thus the name "mouse" was born. The first mouse was made of wood and featured rounded edges and small tracking wheels that moved the pointer feature vertically and horizontally. It had three buttons that each performed a different function. "[It is] palm-filling size, has a flexible cord, and is operated by moving it over a suitable hard surface that has no other function than to generate the proper mixture of rolling and sliding motions," Engelbart explained. "It stays put when your hand leaves it to do something else (type or move a paper) and re-accessing proves quick and free from fumbling. Also, it allows you to shift your posture easily, which is important during long work sessions."

The mouse became a part of computer technology on June 21, 1967, when Engelbart applied for a patent on his invention. Its official name was the "X-Y Position Indicator for a Display System." Together, the windows environment and the mouse formed a system that the SRI staffers called the "oNLine System," or NLS.

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> *Engelbart's invention of windows and the mouse changed the basic ways computers were used, as Sam Witt and Sean Durking summed up in 1999 in* Computerworld *magazine: "It was the beginning of a revolution in the way people work, communicate, and produce."*
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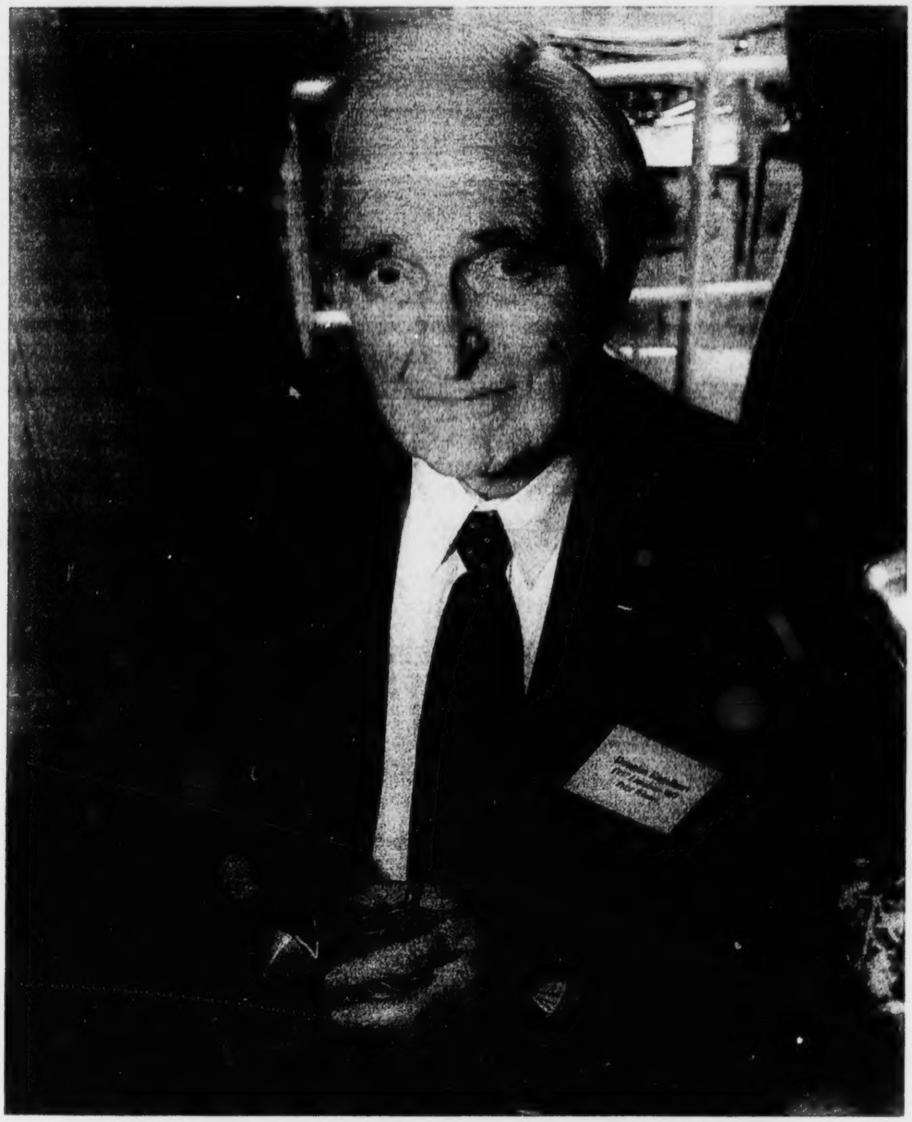
The Importance of Engelbart's Inventions

It is hard to overstate the importance of these innovations. At the time Engelbart introduced his inventions, data was entered into computers using punch cards. Processing information and producing output could take days. Only highly trained professionals could use computers, and controlling them required mastering hard-to-learn computer programming languages. But Engelbart's invention of windows and the mouse changed the basic ways computers were used, as Sam Witt and Sean Durking summed up in 1999 in *Computerworld* magazine: "It was the beginning of a revolution in the way people work, communicate, and produce."

The change occurred on December 9, 1968, at the Joint Computer Conference in San Francisco. In what is still called "the mother of all demos,"



Engelbart posing with the computer mouse after winning the Lemelson-MIT award, April 1997.

Engelbart and other team members demonstrated the entire NLS to a group of awed engineers and computer scientists. At one point in his groundbreaking demonstration, Engelbart turned over control of the mouse to team members back at the Augmentation Research Center, more than 40 miles away. The team was visible to the crowd on a grainy video screen. Engelbart thus was also responsible for the first two-way computer-video teleconference, which today is an important part of the business and scientific worlds.

The history-making demonstration went off without a hitch. So much happened at the conference that it is easy to overlook the fact that the SRI team also unveiled other innovations — such as full-screen text editing (like that used in modern word processing programs) and hypermedia — as well as windows and the mouse. "At the end of 1968, we had developed not only the mouse, but also full-screen editing, a Windows-like interface, links, and hypermedia, a sort of PowerPoint [presentation software that creates charts, graphs, slides, and other forms of output]. We also demonstrated teleconferencing," Engelbart remembered. "It showed collaborative computing — an intuitive picture of how things could be."

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> *"At the end of 1968, we had developed not only the mouse, but also full-screen editing, a Windows-like interface, links, and hypermedia, a sort of PowerPoint [presentation software that creates charts, graphs, slides, and other forms of output]. We also demonstrated teleconferencing. It showed collaborative computing — an intuitive picture of how things could be."*
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Continuing to Struggle for Recognition

Despite the buzz Engelbart's inventions created in the computer industry, his supervisors at SRI still did not understand the importance of his discoveries. In the years following the 1968 demonstration, he received little support. In 1973, Engelbart wrote a paper called "The Augmented Knowledge Workshop," in which he accurately predicted the information revolution of the 1990s. He noted that "the largest single group [of Americans] was professional, managerial, and technical — that is, knowledge workers. By 1975-1980 this group will embrace the majority of Americans." Using his computer tools to manipulate knowledge, these educated Americans could create "the office of the future," Engelbart wrote.

SRI failed to see this potential and took no steps to market the computer mouse and windows environment. But while the research center did not take advantage of Engelbart's inventions, other companies did. Steve Jobs, the co-founder of Apple Computer, saw a version of Engelbart's mouse and NLS several years after it was created. (For more information on Jobs, see *Biography Today* 1992 and the entry in this volume.) Jobs immediately knew he was seeing the future of computing, and he developed his own version of NLS and the mouse in launching Apple's Lisa and Macintosh computers. Another company to benefit greatly was Logitech, which was founded in 1981 by two Swiss engineers. The company used Engelbart's technology to create its own mouse. By 1999, Logitech had sold more than 200 million of the pointing devices to personal computer users.

Despite these enormous success stories, Engelbart has gained almost no financial benefit from his inventions. Although many of the patents were in his name, the rights to the inventions were actually owned by SRI. SRI claimed that Engelbart was just doing the job he was being paid to do when he invented the mouse. Other than his regular paycheck, the only bonus he received from SRI was a one-time award of $10,000. While that might bother some people, Engelbart was unfazed. "I made a conscious decision at age 25 that money would be secondary," he stated.

In 1977, Engelbart's work at SRI came to an end when his funding was cut off. "There was a slightly less than universal perception of our value at SRI," he recalled later. His work had been funded by the Advanced Research Project Agency (ARPA) of the U.S. Department of Defense. ARPA was interested in any technology or weapon that could improve the abilities of the U.S. Army. A few visionaries at that agency saw the power of computers and imagined their potential applications on the battlefield. ARPA spent more than $25 million a year on grants and research funds during the 1960s and early 1970s and even created the computer network called ARPAnet, which would eventually evolve into the Internet.

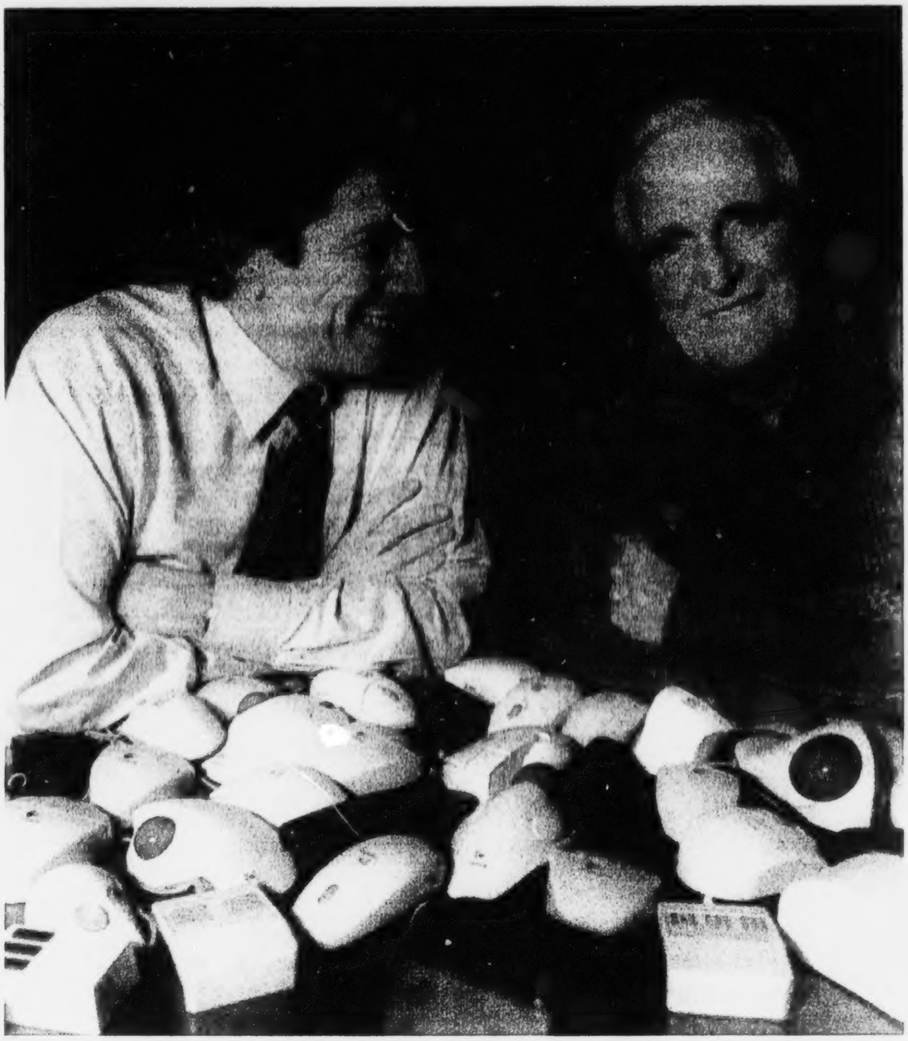
> *"This whole bootstrap strategy is to invest in your improvement so that the results not only improve your operations but improve your improvement process. What if, as we paid early, special attention to learn how to be more effective collectively, we applied as much of the new capability as possible to improving selected parts of society's improvement infrastructure? The better that gets, the better we're going to improve all the other things we want to improve, including how you're going to improve improvement."*

The first mouse (left) sits with its modern day counterpart (right).

When ARPA cut off funding to the Augmentation Research Center, SRI sold the entire group to a computer company called Tymshare. Engelbart worked at Tymshare for seven years, until it was acquired by McDonnell Douglas in 1984. He then returned to Stanford University, where he founded the Bootstrap Institute. Engelbart's original NLS, which was renamed Augment during his time with Tymshare, traveled with him. Each of his employers bought the rights to the system. McDonnell Douglas currently licenses Augment to the Bootstrap Institute.

The Bootstrap Institute

The Bootstrap Institute started as the Bootstrap Project in 1989. Two years later it was launched as a separate group, with Engelbart acting as director. His ultimate goal at the institute is to create an "improvement community" that will work to increase the efficiency of the human race by coming up with new ways to work together. "This whole bootstrap strategy is to invest in your improvement so that the results not only improve your operations but improve your improvement process," he explained. "What if, as we paid early, special attention to learn how to be more effective collectively, we applied as much of the new capability as possible to improving selected parts of society's improvement infrastructure? The better that gets,



Engelbart and Guerrino De Luca, President and CEO of Logitech, a manufacturer of the computer mouse.

the better we're going to improve all the other things we want to improve, including how you're going to improve improvement."

The institute also strives to help businesses and other organizations become high-performance organizations. For example, it uses collaborative computer technologies to refine improvement strategies and increase each organization's ability to improve. To attain its goals, the institute is putting together a group of individuals, companies, educational institutions, and government agencies that will work together to "improve improvement."

Open Source Technology

One way that Engelbart thinks greater improvements can occur is through a growing commitment to "open source technology." Open source is a technique pioneered by computer programmers to share technology, in the belief that letting others view the computer code used to create software and systems increases the chances that new, brilliant ideas will be added to the code. These programmers figure that if people cannot see the code, they cannot improve on it. In an open source environment, programmers do not try to develop new products in secret in order to gain a business and financial advantage. Instead, they share all the new source code and programming instructions they develop. That means that any other programmer in the world can use the code and try to make it better, as long as they continue the process by sharing any new code that they create.

Engelbart believes that open source technology and other continuous improvement methods enable people to "tap the full potential" of networks and programming ability, which makes them better able to solve complex problems. The growth of the Internet — through which computer code can be shared easily and instantly — has led to rapid expansion of the open source movement. Sharing of technology is expected to continue to increase, although many businesses still resist the idea because they feel their products will be stolen by competitors. Engelbart knows this resistance will be difficult to overcome. "Going after this in a serious way is in itself a complex problem," he admitted.

> *"I'm just as frustrated now [as in the 1960s]. The things that we produced in the '60s and '70s and couldn't get people to listen to, I feel exactly the same way now about this [bootstrapping] stuff. Why aren't they listening? It's a rhetorical question because I know more about why, but . . . I actually get pretty depressed."*

One of the main projects at Bootstrap is related to the idea of open source technology. This project is called the Open Hyperdocument System (OHS). It is a functional part of one of Engelbart's main beliefs — that the world is becoming so complex, and the amount of knowledge is growing so fast, that there has to be a universally accepted way to gather that knowledge and share. Otherwise, he fears that the knowledge will be lost and improvements will not be made. "For 15 or more years, it has been clear to me that an OHS has to emerge as a common basis upon which to build the world's evolving knowledge base," Engelbart stated.

Engelbart's OHS system would create a universal means of sharing ideas, data, and images. It would also create universal methods of storing, viewing, and manipulating that information. Since Engelbart strongly believes that there is no one person or group that can invent such a system on its own, he is firmly committed to the idea of using a "large-scale evolutionary process" to create the system. In other words, he plans to open the system to the entire world and let anyone contribute to its development.

In his work at the Bootstrap Institute, Engelbart focuses on the future rather than dwelling on his past accomplishments. He recognizes that the mouse has played an important role in changing the way computers operate, but he is a bit troubled by the fact that it is the one thing for which he is best known. To him, the mouse is just a tool, and the issues that forced the creation of that tool are far more important than the tool itself. He would like to see people—especially in the scientific community—spend more time thinking about how they can be more effective collectively in order to solve large-scale problems. "I really feel like the kinds of problems, the complexity the world's getting into, are such that if we don't really get going on something explicit about bootstrapping, we could just see the whole human race tripping and sprawling," he noted.

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> *When asked to sum up his 50-year career in the computer industry, Engelbart once said that his main goal was "to help mankind get collectively better able to cope with complex, urgent problems."*
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In early 2000, Engelbart led a 10-week series of lectures and educational presentations at Stanford University called "An In-Depth Look at the Unfinished Revolution." In addition to the live audience that attended, the 10-week event was also broadcast live over the Internet. This series, which featured guest speakers from business, education, and the government, was designed to address the main areas of concern of the Bootstrap Institute—mainly, how to use computers to improve collective intelligence. Engelbart's presentations focused on "how nations and their organizations can develop their improvement infrastructure to cope with the challenges of change."

Although Engelbart knows that his work is important, he realizes that it may take time to change decades of thinking in the business and scientific communities. "I'm just as frustrated now [as in the 1960s]," he stated. "The things that we produced in the '60s and '70s and couldn't get people to listen to, I feel exactly the same way now about this [bootstrapping] stuff. Why aren't they listening? It's a rhetorical question because I know more about why, but . . . I actually get pretty depressed."

MARRIAGE AND FAMILY

Engelbart married his wife, Ballard, in 1950. They had four children together. Sadly, his wife died in 1996. Engelbart lives in the San Francisco Bay area.

HOBBIES AND OTHER INTERESTS

In his spare time, Engelbart enjoys hiking, camping, sailing, reading, bike riding, folk dancing, and exercising. He also has created science fiction fantasy stories for children.

HONORS AND AWARDS

Distinguished Alumni of the Year (Oregon State University): 1987
Lifetime Achievement Award for Technical Excellence (*PC* magazine): 1987
Lifetime Achievement Award for Vision, Inspiration, and Contributions (Electronic Networking Association): 1990
American Ingenuity Award (National Association Manufacturers' Congress of American Industry): 1991
Coors American Ingenuity Award: 1991
Pioneer of the Electronic Frontier (Electronic Frontier Foundation): 1992
Price Waterhouse Lifetime Achievement Award: 1994
A.M. Turing Award (ACM): 1997
Jerome H. Lemelson-MIT Prize for Excellence in Invention and Innovation: 1997
Benjamin Franklin Medal in Computer and Cognitive Sciences (The Franklin Institute): 1998
National Inventors Hall of Fame: 1998
Ronald H. Brown American Innovator Award (U.S. Department of Commerce): 1998
John Von Neumann Medal (Institute of Electronic and Electrical Engineers): 1999
Weldon B. Gibson Achievement Award (SRI International): 1999
National Medal of Technology: 2000

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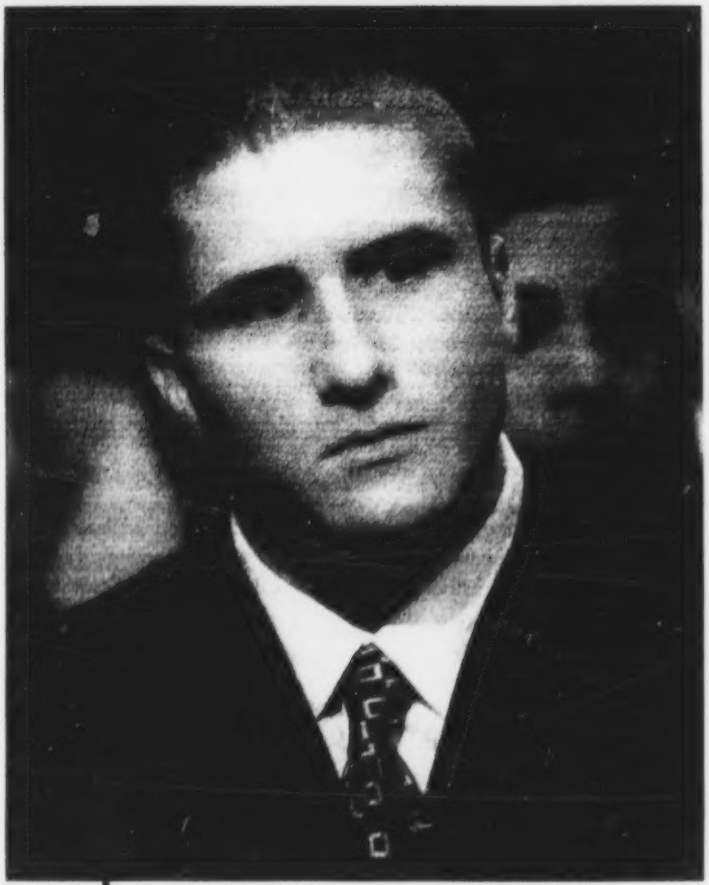
U.S. News and World Report, May 20, 1996, p.47

ADDRESS

Bootstrap Institute
6505 Kaiser Drive
Fremont, CA 94555-3614

WORLD WIDE WEB SITES

http://www.bootstrap.org/org.htm#Douglas
http://sloan.stanford.edu/MouseSite
http://invent.org/book/book-text/engelbart.html



Shawn Fanning 1980-

American Computer Software Developer
Creator of the Internet Music-Sharing Application
Napster

BIRTH

Shawn Fanning was born in November 1980 in Brockton, Massachusetts. His mother, Colleen (Fanning) Verrier, is a nurse's aide. She had Shawn when she was 17 years old. His biological father, Joseph Rando, was not involved in his upbringing. When Shawn was young, his mother married Raymond Verrier, a former U.S. Marine who drives a delivery truck for a local bakery. Shawn later gained three younger half-brothers and a younger half-sister.

> *"When I received my computer, I just got completely sucked in. And so what happened was I started compromising my schoolwork. I quit all the sports I was playing and focused all my energy on learning about software development."*

YOUTH

While Fanning was growing up, his family often struggled to make ends meet. "Money was always a pretty big issue," he recalled. "There was a lot of tension around that." When he was in sixth grade, his mother and stepfather separated for a while, and the children ended up in foster care for a year. It was a difficult time for Fanning. "I don't think about it much," he noted. "I try to block it out." Once the family reunited, they moved to Harwich Port, a suburb of Boston.

As he entered his teen years, Fanning began playing guitar in a band that covered tunes by heavy-metal bands like Metallica and Led Zeppelin. He also enjoyed playing sports and was a very good athlete. One day, when he was playing pick-up basketball with a friend from middle school, he acquired a nickname that stuck. "I was playing basketball with a friend," Fanning remembered. "We were talking trash back and forth, and at that time my hair was growing out a little bit. He said I had 'nappy' hair, because when it grows, it gets all curly. I got really mad at him, so he kept saying it. . . . Even though I kept my hair very short, pretty soon it turned into a nickname." From that time on, Fanning was known around the neighborhood as the Napster.

Fanning's uncle, John Fanning, was an entrepreneur who ran a computer games company called NetGames. He always took an interest in young Shawn and encouraged him to work hard in school by paying him $100 for each "A" on his report card. When Shawn was a sophomore in high school, his uncle gave him an Apple Macintosh computer and paid for an extra phone line so he could connect to the Internet. John Fanning hoped his nephew would become interested in computer programming, and it worked. "I saw this as a way for him to work his way out of his situation," he explained. "He absorbed the stuff faster than anyone I've ever known." Shawn used his computer to chat with other kids from all over the world on the Internet, always using the login name Napster. He also spent every summer during high school working as an intern at his uncle's company.

EDUCATION

Fanning attended Harwich High School, where he was a good student when he remained focused on his schoolwork. He also starred on the school's basketball and baseball teams. In fact, he hit .750 and played shortstop on a team that won the Massachusetts high school baseball state championship. But both his schoolwork and his extracurricular activities fell by the wayside once he received his first computer from his uncle. "When I received my computer, I just got completely sucked in," he recalled. "And so what happened was I started compromising my schoolwork. I quit all the sports I was playing and focused all my energy on learning about software development."

Fanning graduated from high school in the spring of 1998. That fall, he entered Northeastern University near Boston to study computer science. Unfortunately, he was bored with his classes and spent most of his time playing on his computer or hanging out with friends and partying. One day, his roommate complained about how difficult it was to find and download music files from the Internet. Fanning immediately became interested in solving the problem. "There was no reliable way of sharing music online," he noted. "I was studying computer science at the time, so I bought a programming book, went back to my dorm room, and wrote some software."

Before long, Fanning became obsessed with the idea of writing a computer program to enable people to exchange music files over the Internet. He worked on the program day and night, either at school or at his uncle's offices. In early 1999, he dropped out of college to devote all his time and energy to the project. "I just stopped going to school. I left my dorm room. I didn't tell any of my friends. . . . I'm sure they were shocked when I stopped showing up. And I left all of my things at school," he remembered. "I knew if I went back, I'd start partying and lose my focus. The only way for me to finish something is to lock myself in an office or location where I won't be distracted."

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CAREER HIGHLIGHTS

Fanning Introduces Napster

At the time Fanning began working on the program that would become Napster, downloading music from the Internet was a slow and cumbersome process. It first became possible to send and store music files electronically in 1987, when a German engineering firm developed a technology known as ISO-MPEG Audio Layer-3, or MP3. MP3 could be used to compress audio tracks on CDs into digital computer files that were small enough to store and transfer easily. Although MP3 files were available on the Internet for many years, they were difficult to locate and copy. Computer users often spent hours going to outdated or dead-end Web sites in search of music files. When they did locate MP3 files, the only way to copy them was by using slow e-mail or file-transfer functions.

Fanning wanted to simplify this process. His idea involved combining three features of programs that already existed: the instant messaging capability of Internet Relay Chat; the file sharing capability of Windows; and the filter and search capability of search engines. He often sought the advice of friends he had met over the Internet, including Sean Parker and Jordan Ritter. Since Fanning was worried that someone else would solve the problem first, he rushed to complete his software and did not have time to make it complicated. "I had to focus on functionality, to keep it real simple," he explained. "With a few more months, I might have added a lot of stuff that would have screwed it up. But in the end, I just wanted to get the thing out."

> *In early 1999, Fanning dropped out of college to devote all his time and energy to the project. "I just stopped going to school. I left my dorm room. I didn't tell any of my friends. . . . I'm sure they were shocked when I stopped showing up. And I left all of my things at school. I knew if I went back, I'd start partying and lose my focus. The only way for me to finish something is to lock myself in an office or location where I won't be distracted."*

By June 1999, Fanning was ready to introduce his new music-sharing software application, which he called Napster. Napster eliminated the problems associated with finding and downloading MP3 files. Sharing music files over the Internet was suddenly very easy. Computer users could sim-

Fanning with the CEO of Napster, Hank Barry (right), after an appearance in Federal court, July 2000.

ply download the free Napster software from the World Wide Web. Napster would automatically search the users' hard drives for MP3 files and add these files to its centralized database of available music. Whenever anyone wanted to find a certain song, they could search Napster's database to find that song on the hard drive of another Napster user. Making a free copy of the song would take just a few minutes and a click of the computer mouse. The Napster Web site also featured a community of chat rooms where people could go to discuss music.

Fanning started out by sending a test version of the Napster software to 30 fellow computer and music buffs he met on the Internet. He asked these people to test and evaluate the program but not share it with anyone else. As it turned out, though, they were so thrilled with Napster that they could not resist spreading the word. Within a week, the Napster software had been downloaded by 15,000 people. Napster was particularly popular on college campuses across the country, where students had access to high-speed computer networks. As the popularity of Napster took off, Fanning's uncle recognized that the software had huge commercial potential. He helped Fanning form a company, Napster Inc., and began looking for investors. The company set up offices in San Mateo, California, which was home to a large number of new Internet ventures.

Fanning officially released a trial version of Napster on the Internet in August 1999, and he updated the software that November. The number of people using the service to exchange music files grew by between 5 and 25 percent each day. Within a year of its release, Napster was being used by 25 million people around the world. "Napster has transformed the MP3 from a tech-head pastime into one of the prime social activities of U.S. college life with the potential to explode internationally," Nick Paton Walsh wrote in the *Observer* (England). Fanning moved to California and became the head software developer in the Napster offices. He found the phenomenal growth of his creation a bit overwhelming. "It's been completely crazy," he stated. "I'm just trying to stay focused on software development and not be distracted by anything else."

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> *One musician who was very outspoken in his opposition to Napster was the rapper Dr. Dre, who objected to the fact that he did not receive royalties for music downloaded through Napster. "Napster is taking food out of my kids' mouths. I've always dreamed about making a living at something that I love to do. And they're destroying my dream."*
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Napster Becomes the Focus of Controversy

Within a few months of its release, Napster became the focus of controversy. It became so popular among college students that it began to overload the computer networks on many campuses. A survey showed that 70 percent of American college students were using Napster at least once per week. Many of these students would leave Napster running on college computers for long periods of time while they downloaded MP3 files or shared their files with other people. This practice used up a great deal of computer capacity and caused technical problems on many networks. Eventually, over 100 colleges banned Napster from their computer networks. Some students signed petitions in protest, while Fanning and other Napster programmers tried to find a technical solution to ease the burden on campus networks.

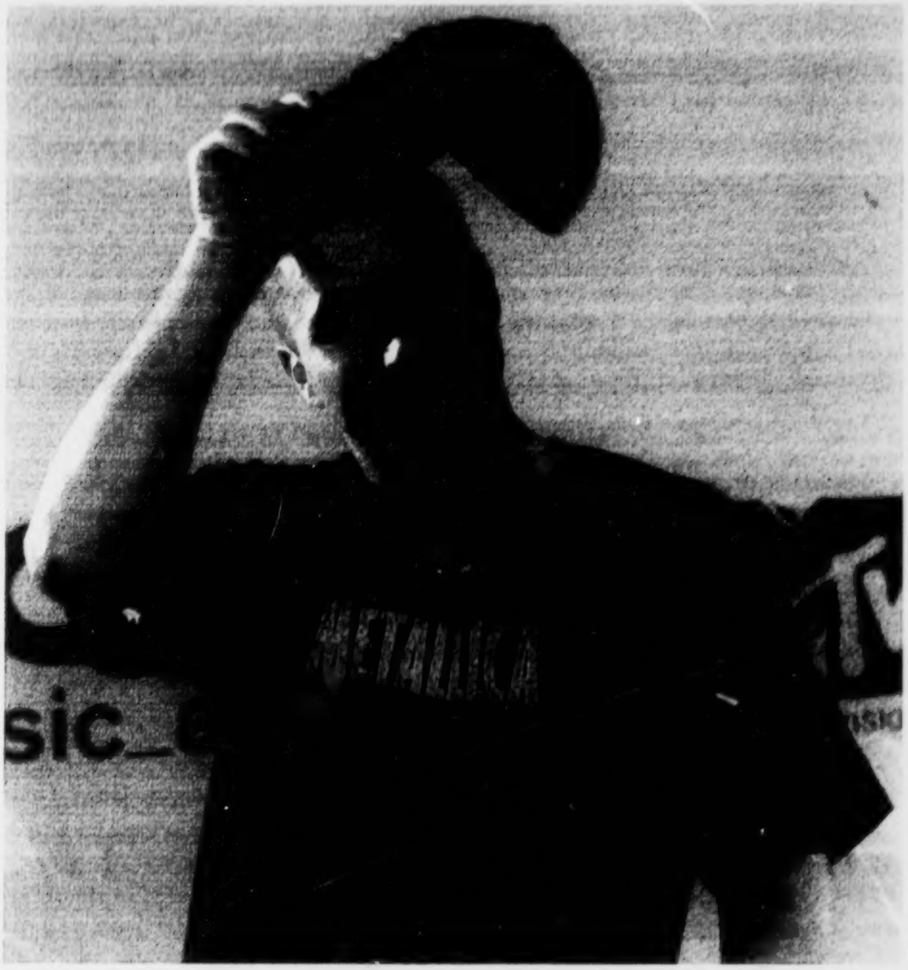
In December 1999, Napster became the subject of a lawsuit filed by the Recording Industry Association of America (RIAA), an industry group that represented several large record companies. The RIAA charged that Napster encouraged its users to violate the copyrights of record companies and recording artists. A copyright is a form of legal protection that is granted to books, songs, photographs, and software. When someone composes a song and protects it by filing for a copyright, no one else can copy the words or music without paying a fee called a royalty. The RIAA argued that Napster users were copying songs illegally without paying royalties. They said that 80 to 90 percent of the MP3 files listed on Napster's central database were illegal copies. Some industry representatives called Napster "the world's biggest bootleg record collection."

The RIAA insisted that Napster was costing the recording industry and individual artists a great deal of money. They said that no one would want to buy CDs anymore if they could copy the music for free over the Internet. Without earning royalties from CD purchases, they argued, musicians would not have any financial incentive to continue to create new songs. Finally, the RIAA claimed that Napster prevented record companies from setting up their own, legitimate Web sites to promote and sell music online. "We're trying to preserve opportunity for a legitimate marketplace to emerge on the Net," said RIAA attorney Cary Sherman. "But we can't do it if we're in competition with a beautifully functioning pirate market."

Fanning and other representatives of Napster disputed the RIAA's charges. For one thing, they argued that Napster only provided the software that enabled people to share music files. They pointed out that no copyrighted material ever passed through the company's computers. Instead, MP3 files were transferred directly from one Napster user's computer to another's. Since Napster never handled the files, they claimed that they could not be held responsible for the behavior of users who may violate copyrights.

Napster representatives also noted that Fanning originally envisioned the software as a way for people to exchange music that was not protected by copyright, such as songs by new, independent artists or by the users themselves. They said that Napster gave added exposure to this type of music and might actually increase CD sales. Finally, Napster representatives argued that copyright law allowed people to copy CDs for their own personal use, or to make "mix tapes" of music for friends. They compared Napster to an interactive radio station that allowed people to talk about music and play songs for each other.

As the RIAA lawsuit made its way through the court system, Napster hired the prominent lawyer David Boies to handle its defense. Boies led the U.S. Justice Department's successful lawsuit to break up the software giant Microsoft, and he also represented Vice President Al Gore in the 2000 presidential election hearings before the U.S. Supreme Court. In July 2000,



Fanning at the MTV Video Music Awards show, September 2000. He was a presenter there.

a federal judge gave Napster 48 hours to either remove all copyrighted material from its database or shut down its popular Web site. In response, tens of thousands of Napster users signed online petitions vowing not to purchase CDs from record companies represented by the RIAA. Hundreds of thousands of others swamped the Napster Web site in a last-minute scramble to download music. A few hours before the deadline, however, a federal appeals court reversed the ruling. They allowed Napster to continue operating until the next round of hearings was completed. "Right now, things are messy," Fanning admitted. "But it's not as bad a situation as many would think."

Musicians Take Sides in the Napster Debate

Throughout the RIAA lawsuit, many musicians and groups have come forward to express their opinions about Napster. The heavy-metal group Metallica — which was always one of Fanning's favorite bands — was one of the earliest and most vocal of Napster's opponents. In fact, members of the group came to the Napster offices with a list of over 300,000 Napster users who had violated their copyrights by downloading illegal copies of their songs. Napster responded by kicking all of the offenders off the service. But most people simply deleted Metallica MP3s from their hard drives and rejoined Napster under another name.

Another musician who was very outspoken in his opposition to Napster was the rapper Dr. Dre. He mainly objected to the fact that he did not receive royalties for music downloaded through Napster. "Napster is taking food out of my kids' mouths," he stated. "I've always dreamed about making a living at something that I love to do. And they're destroying my dream." Fanning understood the artists' concerns, but he felt that they could resolve their differences and work together. "Bands like Metallica are just really passionate about their music, and there's nothing wrong with that," he stated. "But we need to be more diplomatic. If you don't understand something about Napster, just come and talk to us. We're interested in talking to artists about how to move the technology forward."

> *"I support the fans," said Chuck D of the rap group Public Enemy. "I see Napster as a new way of exposure. The fans found a new technology, and a lot of artists will be able to share a bigger money pie that has been dominated by four major corporations who want to dominate how music is distributed. . . . It's going to kill off the dinosaurs, and force them to rewrite the way they do business."*

At the same time, a number of other artists expressed their support for Napster, including the alternative rock groups Smashing Pumpkins and Hole. These artists believed that Napster helped expose more people to their music. They also felt that opening up the Internet for the exchange of music might help loosen the control of big record labels over musicians. "I support the fans," said Chuck D of the rap group Public Enemy. "I see Napster as a new way of exposure. The fans found a new technology, and a lot of artists will be able to share a bigger money pie that has been dominated by four major corporations who want to dominate how music is distributed. . . . It's going to kill off the dinosaurs, and force them to rewrite the way they do business."

Napster's Uncertain Future

The RIAA lawsuit has created a great deal of uncertainty about Napster's future. Many people are anxiously awaiting the outcome of the case to see what happens to Napster. It appears that the case will be appealed all the way to the U.S. Supreme Court. In the meantime, Napster has begun making deals with record companies. In December 2000, the company signed a deal with the German label Bertelsmann AG that requires Napster to pay royalties when its users exchange songs by Bertelsmann artists.

Some observers believe that Napster's outlaw reputation will ultimately cause it to go out of business. But others feel that record companies and recording artists will have to find a way to work with online music exchanges like Napster in the near future. After all, people probably will not stop swapping MP3 files if Napster is forced to shut down its Web site. Instead, they will simply use one of the many "copycat" sites that have grown out of Napster's popularity.

Adding to the uncertainty surrounding Napster is the fact that the company has yet to earn any money from Fanning's phenomenally popular music-sharing software. The Napster program is available free on the Internet, and the company does not charge fees for access to its chat rooms or other features. So far, Napster's only source of income has been funds provided by investors hoping to benefit from some future commercial application of the software or Web site.

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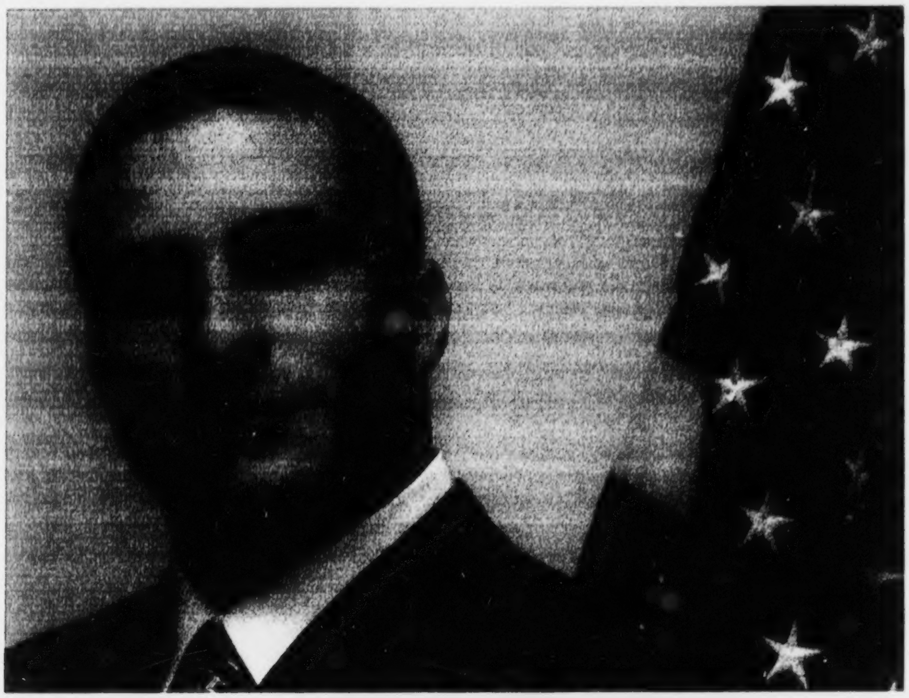
Some analysts have speculated that Napster may try to raise money to continue its operations by offering stock to the public. Others think that the company might sell advertising space on its Web site, charge users membership fees to join the service, or make deals with record companies



Fanning at an appeals court during litigation with the Recording Industry Association of America, October 2000.

to promote artists. "We think that ultimately Napster can be transformed into something that's extremely powerful from the user, industry, and artist perspectives," Fanning stated. "It's just a question of whether everyone works together to develop it and build it out."

Although Fanning is the best-known representative of Napster, he does not hold any managerial responsibility at the company. He works there full-time and is in charge of software development, but he owns less than 10 percent of the business. The rest belongs to his uncle and assorted other investors. Napster Inc. is run by several of its largest investors, along with top executives hired from within the computer and recording industries.

Even if Napster ceases to exist, many Internet experts agree that Fanning created a "killer application" that has fundamentally changed the way people do things online. Napster ushered in a new era of "peer-to-peer computing," which allows people's computers to communicate and exchange information directly, without going through the larger World Wide Web. As a result, people can search for data on countless hard drives simultaneously and download information faster and more efficiently.

HOME AND FAMILY

Fanning shares a two-bedroom apartment in San Mateo with Sean Parker, one of his online friends who helped develop the original Napster software. Their place is very much a bachelor pad, with pizza boxes lying around and a steady flow of friends and co-workers streaming in and out of the living room at all hours. Fanning has a girlfriend but refuses to talk about her. He admits that his fame as the founder of Napster has helped him attract the attention of young women, but he claims that it has also left him little time for dating.

Fanning remains close to his family back in Massachusetts and wishes he could see them more often. He has used part of his six-figure salary as head software developer at Napster to help his mother and stepfather get out of debt. His mother worried about him when he dropped out of college to start Napster, but now she is proud of his accomplishments. "This is one child who will not look back on his life and say 'I should have.' That is why he is loved so much by his family. We are very proud of him taking risks and trying to build a better music system via the Internet," his mother stated. "I still worry. . . . There's a lot of stress, a lot of attention, a lot for someone his age to handle."

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> *Fanning has considered quitting Napster and going back to school. "Look, I'm not like some super geek. I enjoy building something, but you get sick of it after awhile. You just want to stop. But I want to make sure the company is in a great position before I start having fun. It's a huge opportunity because we're really popular in all these schools and it's really tempting to go and party. But I have this fear that if I get caught up it will all fall apart. Maybe I'm overestimating my importance."*
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In 1998, Fanning's uncle helped him reestablish contact with his biological father, Joseph Rando. They met for lunch and then drove around talking for a few hours, and they have stayed in touch since then. As it turns out, Fanning's father runs a computer software company.

HOBBIES AND OTHER INTERESTS

Fanning's busy work schedule leaves him little time for fun. He is usually in the Napster offices writing computer code from about 10:00 A.M. to

1:00 A.M., seven days a week Then, in the middle of the night, he goes to a nearby gym to lift weights. He has begun to feel the strain of the lawsuit and all the media attention. In fact, he admits that he has considered quitting Napster and going back to school. "Look, I'm not like some super geek. I enjoy building something, but you get sick of it after awhile. You just want to stop," he stated. "But I want to make sure the company is in a great position before I start having fun. It's a huge opportunity because we're really popular in all these schools and it's really tempting to go and party. But I have this fear that if I get caught up it will all fall apart. Maybe I'm overestimating my importance."

AWARDS AND HONORS

Top 25 Internet VIPs (*Business Week*): 2000
Person of the Year (*PC* magazine): 2000
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FURTHER READING

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ADDRESS

Napster, Inc.
1475 Veterans Blvd.
Redwood, CA 94063

WORLD WIDE WEB SITE

http://www.napster.com

Sarah Flannery 1982-

Irish Student and Amateur Cryptographer
Developed an Innovative System of Encoding
Information Sent over the Internet

BIRTH

Sarah Flannery was born on January 31, 1982, in Blarney, County Cork, Ireland. She is the oldest of five children born to David Flannery, who is a professor of mathematics at the Cork Institute of Technology, and Elaine Flannery, who also teaches there part time in biology and microbiology. Sarah's younger brothers are Michael, David, Brian, and Eammon.

YOUTH

Flannery was always an active girl with a creative mind. From the time she was six years old, her father encouraged her creative thinking by giving her mathematical puzzles to solve. He would write a puzzle on the blackboard in the family's kitchen each day to engage and challenge the children. "Strictly speaking, it is not true to say that I or my brothers don't get any help with mathematics," Flannery explained. "We are given no extra classes, nor do we have to endure intense sessions at the kitchen table from overzealous parents. But almost without our knowing we have been receiving help ever since we were very young, out-of-the-ordinary help of a subtle and playful kind which I think has made us self-confident in problem solving. Ever since I can remember, my father has set us to little problems and puzzles."

One of the main benefits of the puzzles was that they demonstrated the many practical applications of mathematics, or "maths," the word that people of the United Kingdom use for mathematics. "These puzzles were challenging and encouraged curiosity, and many of them made maths interesting and tangible," she noted. "More fundamentally, they taught us how to reason and think for ourselves." Over time, Flannery and her brothers came to see math as a useful and exciting tool, rather than something to avoid. "The fear of numbers is passed on to children by parents and teachers. Often, too, maths is taught in a boring, routine way, with endless repetitions. And teachers talk about abstractions like *x* and *y* when they could relate the calculations to the real world," she stated. "I have always enjoyed maths because my father made it fun."

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Flannery gave an example of the kind of puzzle she enjoyed as a child: "You are in a room and somewhere out of sight there are three rooms. In yours there are three switches, each lighting one of the three rooms. By only visiting each room once and only coming to the switch once, how do you figure out which switch works which room?" Even as a young girl, Flannery came up with the answer within five minutes: You leave one switch off, turn one of the other switches on, and then wait ten minutes. At the end of that time, you turn the third switch on and visit all three rooms. The room that is dark is controlled by the first switch; the room with a light on and a hot lightbulb is controlled by the second switch; and the room with a light on and a lightbulb that is just starting to warm up is controlled by the third switch.

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"The fear of numbers is passed on to children by parents and teachers. Often, too, maths is taught in a boring, routine way, with endless repetitions. And teachers talk about abstractions like x *and* y *when they could relate the calculations to the real world. I have always enjoyed maths because my father made it fun."*

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EDUCATION

Flannery received her primary education at the local all-girls' school in Blarney. She then attended Scoil Mhuire Gan Smal, a respected co-ed secondary school in the area. She was a good student—especially in math and science—and also participated in basketball, Gaelic football, and cross-country. She graduated from high school in the spring of 2000. That fall, she continued her education at Peterhouse College at Cambridge University in England.

CAREER HIGHLIGHTS

Developing an Interest in Cryptography

As a teenager, Flannery became interested in cryptography. She described cryptography as "the science of secrecy, a science which studies methods of putting disguises on messages or information, so only the person you want to be able to read that information can." The earliest forms of cryptography involved substituting one letter of the alphabet for another. For example, *A* and *Z* might represent each other, as might *B* and *Y*, *C* and *X*, and so on through the alphabet. Using this simple system, the word *cat* would be written as *xzg*.

The Flannery family kitchen, with Eammon at the blackboard working on a puzzle.

In recent years, cryptography has become an important field of study as people have searched for ways to protect private information (like credit card numbers used in electronic business) sent over the worldwide computer network known as the Internet. But unlike the early examples of cryptography—which could easily be broken using computer technology—modern methods of encoding information usually involve complicated mathematical formulas. Flannery first became interested in cryptography because it provided a practical application of mathematics, like the puzzles she had enjoyed as a child. "Cryptography is just such a beautiful example of the application of very pure maths," she stated. "It's a hot topic at the moment."

The best-known system of encrypting electronic data for transmission over the Internet is called RSA. This system was developed in the late 1970s and named after the three graduates of the Massachusetts Institute of Technology who created it—Ronald Rivest, Adi Shamir, and Leonard Adleman. As of 2000, there were 300 million copies of the RSA encryption program installed on computer systems worldwide. RSA is used to scramble e-mail messages, business documents, legal agreements, credit card transactions, and other private information that is stored or transmitted in electronic form. RSA scrambles data in a certain way based on the product of two prime numbers (a prime number is a number which can only be divided by itself and one). Each of the two prime numbers are 100 digits long. RSA is known as a public key encryption system because many people can use it to encode information, but only the person who holds the key (knows the value of the two prime numbers) can decode it again.

In 1998, Flannery wrote a research paper about cryptography. This paper, called "Cryptography—The Science of Secrecy," outlined the history and major developments in the field. She also created some computer programs to demonstrate various methods of encrypting and decrypting electronic data, including RSA. She entered her project in the Esat Telecom Young Scientist and Technology Exhibition, held each year in Dublin, Ireland. She was thrilled when she won first prize in the Individual Mathematics, Physics, and Chemistry category. At the end of the competition, she also received the Intel Excellence Award, which meant that she would be invited to represent Ireland at the Intel International Science and Engineering Fair (ISEF) in Fort Worth, Texas, later that year.

> *"When a reply came with an invitation to spend a week [as an intern] with these information security specialists, I could not have been more pleased and frightened at the same time. But I was determined not to let an opportunity like this pass me by, and though I feared I might find myself way out of my depth in the company of top cryptographers, I made myself go."*

Creating Her Own Encryption Algorithm

Upon reaching the age of 15, Irish secondary school students have the option of completing a brief internship with a company or other organization. Known as "work experience," this program is intended to expose students to real-world problems and issues. Flannery decided to use her work experience as a way to expand and improve upon her cryptography project before taking it to the ISEF competition. She applied for an internship with Baltimore Technologies, a Dublin-based computer security firm. "When a reply came with an invitation to spend a week with these information security specialists, I could not have been more pleased and frightened at the same time," she recalled. "But I was determined not to let an opportunity like this pass me by, and though I feared I might find myself way out of my depth in the company of top cryptographers, I made myself go."

The head of Baltimore Technologies was a prominent mathematician named Dr. Michael Purser. Purser had been working on a new algorithm, or step-by-step procedure, to encrypt information using a complicated mathematical formula. Flannery arrived for her work experience just as Purser was leaving on vacation. When it became clear that the young student understood a great deal about cryptography, Purser's staff suggested that she take a look at his algorithm while he was gone. "This lassie Sarah Flannery came to do work experience from school," Purser remembered. "It was immediately perceived that she could do more than [make] the tea, and they said, 'Can you program?' And when she said yes, they said, 'Why don't you try and program this idea of Michael Purser's?' So that's what she did."

Flannery made a great deal of progress on the program during her week at Baltimore Technologies. Once she returned to school, she continued working on Purser's basic ideas and began adding ideas of her own. "She became captivated by it," her father recalled. "Sometimes it is good not to know that something is harder than you think it is." Flannery worked with prime numbers that were more than 200 digits long. Purser had placed these numbers into complex, four-by-four matrices (a matrix involves arranging numbers into rows and columns which can be manipulated by adding, multiplying, or using other functions). Flannery came up with the idea of using simpler, two-by-two matrices instead.

Within a few months, Flannery had created her own public key encryption algorithm. She named it the Cayley-Purser (CP) algorithm, after Arthur Cayley—a 19th-century mathematician known for his work with matrices—and Dr. Michael Purser. Like the popular RSA system, Flannery's CP algorithm scrambled electronic data using very large prime numbers. But because her system relied upon simple matrices instead of complicated mathematical formulas, it worked 20 times faster than the RSA system. "It was cool, it was such a practical application, you could see things working," she recalled. "I could see the algorithm actually implementing and making text into gobbledegook, it was all really interesting and really new."

Flannery incorporated her new encryption algorithm into the project she entered in the ISEF competition. The expanded project was called "Cryptography—A New Algorithm Versus the RSA." Judges in the United States had to call in mathematics experts to help them understand the underlying principles of the CP algorithm. In the end, however, they termed her

Flannery at the blackboard working on some of the ideas behind her cryptography project.

project "brilliant" and awarded her first prize. In 1999, Flannery entered her improved project in the Esat Telecom Young Scientists and Technology Exhibition in Ireland, where she won the top overall prize. She was also invited to represent Ireland at the European Young Scientist of the Year competition in Athens, Greece.

Becoming a Worldwide Celebrity

The story of Flannery's award-winning encryption algorithm ended up on the front page of the *Times* of London. Before long, reporters from news services all over the world were calling, wanting to talk to the "girl genius" who had revolutionized the science of cryptography. Flannery was suddenly in great demand for interviews and public appearances. Several colleges offered her scholarships, and several companies expressed interest in buying the rights to her algorithm.

Some people seemed to think that the CP algorithm could be worth millions of dollars if it were developed commercially. But Flannery dismissed the idea of trying to obtain a patent (a form of legal protection for an invention) on her encryption program. "I certainly didn't set out when doing my project to make any money. I set out to have some fun with it," she explained. "The patent thing would mean that people would have to pay for it. The RSA, the other standard system, is available free on the Internet as are many, many other systems of coding. My project is mainly maths. Patenting maths doesn't help anyone to help science to move on again from where it is at the moment."

In all of her interviews, Flannery was careful to share credit for her algorithm with Dr. Purser and the staff at Baltimore Technologies. She also stressed that the CP algorithm was unproven and still needed to be tested by experts before it could be declared as good as the RSA system. "It would have to be tested for a long time before anyone would put money in it," she acknowledged. "RSA is very strong. It would take a few years before other people would want to test it themselves."

> *"I certainly didn't set out when doing my [cryptography] project to make any money. I set out to have some fun with it. The patent thing would mean that people would have to pay for it. The RSA, the other standard system, is available free on the Internet as are many, many other systems of coding. My project is mainly maths. Patenting maths doesn't help anyone to help science to move on again from where it is at the moment."*

Discovering a Flaw in Her Encryption Program

Shortly before Flannery presented her project at the European Young Scientist competition, a mathematics expert announced that he had found a flaw in the CP algorithm that made it vulnerable to attack. Flannery and the staff at Baltimore Technologies struggled to fix the problem, but they were unable to do so. This meant that the CP algorithm was no longer a legitimate alternative to the RSA system for public key encryption of electronic data. It was possible for people with sophisticated computer technology and mathematical ability to break the code and decrypt the information without holding the key. Still, encryption experts noted that Flannery's basic concept was still valuable and would probably be developed further to help speed up the encryption process.

"When the possibility of an attack on the CP algorithm was first made known to me, I was desperately disappointed," Flannery admitted. "Now that I had been in the public eye so much I couldn't help feeling that I had perpetrated some kind of giant fraud. Deep down, of course, I knew I hadn't done any such thing. I had repeatedly said to reporters that the algorithm was being praised before it had been appraised; that it had not been subjected to the kind of peer review by competent cryptographers that is necessary before any system can be judged to have any merit. Although some did report these cautionary comments, many chose not to. I know most people wouldn't care a straw one way or the other, but for me it was vitally important that people in the mathematical world who had helped me and whom I respected could see that I wasn't making any over-the-top claims."

Flannery worried that the flaw in her program would ruin her chances at the European Young Scientist competition. She felt that she needed to explain the flaw as part of her presentation. "I went over not expecting anything," she remembered. "I thought they would think I'm a fraud. I felt horrible telling each judge about the attack on the code." Despite the flaw in her algorithm, Flannery's project impressed the judges in Athens. She received first prize and was named European Young Scientist of the Year for 1999. "It was the most exciting moment of all because it proved to me that it wasn't just the result they were rewarding but me, my work and my presentation," she noted. "It gave me back my confidence."

> *"Exaggeration weakens everything it touches and those who call Sarah a genius do her a great disservice," her father stated. "She's a very clever girl who did a lot of very good mathematics because she became very interested and passionate about the project she was doing. And that's the real mover, and that's what I think is very important for young people to realize, that you only do good work if you enjoy it."*

Publishing a Book about Her Experiences

In 2000, Flannery published a book about her experiences called *In Code: A Mathematical Journey*. Co-written with her father, the book contains a great deal of information about cryptography and mathematics, including some of the puzzles Flannery enjoyed as a child. "It does tell my personal story, but through that it tells a lovely story about maths," she explained. "Even if someone learns one thing, or sees one puzzle they find interesting, that's a way to show people that maths isn't that hard." Excerpts from Flannery's book were published as a series in the *London Telegraph,* and she gave interviews and made promotional appearances around the world.

Through all the awards and public attention, Flannery struggled to maintain some aspects of a normal life. She noted in her book that she learned many things from her experiences, but that she often found it difficult to deal with the publicity. "On the good side, it has taught me that if you want something, go and get it," she stated. "But it brought my childhood to an end: I've had so much to do and so many responsibilities that I've had no time for anything else. The publicity, too, has been very strange—people feel they know me. At school there's been some mocking—'Oh, there's the young scientist,' they say—and I'm under a lot of pressure because of the genius tag. I know I can't live up to expectations."

Both Flannery and her family have emphasized repeatedly that she is not a genius. They believe that this label puts too much pressure on her and fails to recognize the hard work that went into her accomplishments. "Exaggeration weakens everything it touches and those who call Sarah a genius do her a great disservice," her father stated. "She's a very clever girl who did a lot of very good mathematics because she became very interested and passionate about the project she was doing. And that's the real mover, and that's what I think is very important for young people to realize, that you only do good work if you enjoy it."

"I'm an ordinary person who worked hard at something, and kept working at it because I found it enjoyable," Flannery added. "By portraying me as a genius they've taken away something that might have been encouraging to other people. They could have said, 'This girl, she worked hard at something, and this is what you can get if you put time into something you're interested in.' I'm not saying I wouldn't like to be taken as a symbol of that, but I certainly don't like being taken as a genius."

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As she wrote and promoted her book, Flannery also found time to study for her Leaving Certificate, which is the equivalent of high school final exams and college entrance exams for Irish students. She is continuing her education in England at Peterhouse College of Cambridge University, where she would like to study mathematics and computer science. She eventually plans to earn a doctorate degree and work for a high-tech company in Ireland. "Ultimately I would like to be one of those lucky people who get paid for doing what they love," she noted.

> *"I'm an ordinary person who worked hard at something, and kept working at it because I found it enjoyable," Flannery added. "By portraying me as a genius they've taken away something that might have been encouraging to other people. They could have said, 'This girl, she worked hard at something, and this is what you can get if you put time into something you're interested in.' I'm not saying I wouldn't like to be taken as a symbol of that, but I certainly don't like being taken as a genius."*

HOME AND FAMILY

When she's not in school, Flannery lives with her family in a turn-of-the-century country farmhouse near the historic Irish village of Blarney. Their home, which is surrounded by dairy farms, overlooks a scenic valley with the River Shournaugh running through it. It is a short walk to the village and the famous Blarney castle. "I absolutely love being here," Flannery noted. "We are two minutes from the village but it is absolutely private."

HOBBIES AND OTHER INTERESTS

Flannery has a wide variety of interests outside of mathematics. She plays the piano and tin whistle, and she likes listening to all kinds of music. Some of her favorite musicians include Bob Dylan, Tracy Chapman, and Jimi Hendrix. Flannery also enjoys cross-country running, basketball, the Irish sports of Gaelic football and hurling, and horseback riding. "My aunt trains show jumpers [horses that compete in equestrian competitions] in Killarney," she said. "That's my real big love. I wouldn't mind working at something like that, but I know in my heart that my career will be in the sciences. One thing this [whole experience of developing the CP algorithm] has taught me is that, if you have a good grounding in maths, you can do just about anything."

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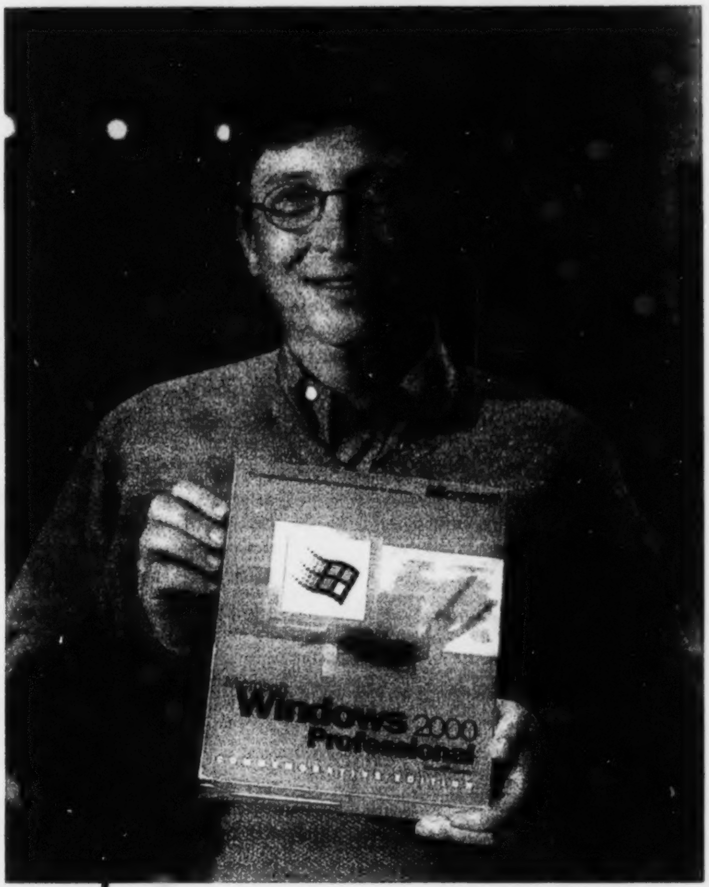
ADDRESS

Workman Publishing
708 Broadway
New York, NY 10003



UPDATE

Bill Gates 1955-

American Computer Software Pioneer
Co-Founder of Microsoft

[Editor's Note: Bill Gates is one of most important people in the history of the computer industry. The personal computer has revolutionized our society, and Gates was one of the people who revolutionized the personal computer. Gates has been so important to the industry that a compute-related book wouldn't be complete without him. Biography Today *first covered Gates in 1993, and brief updates on his activities have also been included in the Appendix to*

the Annual Cumulation in 1998, 1999, and 2000. But the past few years have been crucial for Gates and for Microsoft. This Update focuses on his life and career since the early 1990s, detailing the important issues facing Microsoft today, the challenges facing the company, and Gates's view of the technological opportunities for the future.]

SOME BACKGROUND ON GATES'S EARLY CAREER

The events that turned Bill Gates into the powerful and influential figure he is today started 25 years ago. It's a legendary story of how two guys started a software company that would grow to be the world's largest—and in the process would make Gates the richest man in the world.

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> ***Gates and Allen developed the credo that has guided the company ever since: "A computer on every desk and in every home, all running Microsoft software."***
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Gates first became interested in computers when he was 13, when his school bought a very rudimentary early model. He and an older fellow student, Paul Allen, spent hours learning how to work it. They remained friends and computer buddies throughout high school and college. In 1975, when Gates was attending Harvard University, Allen showed him an article in *Popular Electronics* magazine about a new computer, the Altair 8800, that could be built from a kit. It was the first microcomputer that was affordable for hobbyists. Allen urged Gates to help him write a computer language that could be used on the Altair. They worked feverishly for several weeks to adapt the programming language BASIC (Beginner's All-Purpose Symbolic Instruction Code), which was used in most large computers. Then Allen flew out to New Mexico and convinced the creator of the Altair to license their language, which they called MS-BASIC. That year, in 1975, Gates and Allen officially founded Microsoft. For a while they both split their time between the company and other activities, Allen with a paying job and Gates with school. In 1976 Allen quit his other job, in 1977 Gates dropped out of school, and they both began devoting themselves full-time to Microsoft. They soon developed the credo that has guided the company ever since: "A computer on every desk and in every home, all running Microsoft software."

Their big break came in 1980, when the computer giant IBM asked Microsoft to write an operating system for the new personal computer they were developing. The operating system is like the computer's brain and central nervous system—it controls all the basic functions of the computer. It's also the program that enables the use of any other software, like word processing or spread sheets. At first, Gates and Allen weren't sure they could write the new operating system in time, and they recommended a competitor. But IBM wanted Microsoft. So they purchased an operating system from another programmer called QDOS—Quick and Dirty Operating System—for $50,000. That $50,000 purchase became the foundation of the product on which their whole company is based. They upgraded it, named it MS-DOS (Microsoft Disk Operating System) and licensed it to IBM. But in what would prove to be a brilliant move, they kept the rights to license it to other manufacturers. And as other companies began to make personal computers, they turned to MS-DOS as well. Soon Microsoft's operating system was running on millions of personal computers.

> *"Moving from character-based DOS to Windows with its graphical user interface was an enormous challenge back in the early 1980s," Stuart Glascock wrote in* **Computer Reseller News.** *"Programmers logged long hours, worked with feeble hardware, designed previously unimaginable new drivers, and created a new paradigm. In effect, they dragged, pushed, pulled, and cajoled DOS into the GUI age for PCs. . . ."*

The next major developments for Microsoft came in the mid-1980s, when two big events hit Microsoft in 1983. One was devastating—Paul Allen was diagnosed with cancer. He went on an extended leave to undergo cancer treatments, and when he recovered, he decided not to return to working at Microsoft but to remain on the Board of Directors. He's gone on to become involved in a host of other ventures, some computer related and some not. But the other big event in 1983 proved to be a much more positive experience for the company. That year, they announced Windows, an extension of MS-DOS.

DEVELOPING WINDOWS

Microsoft created Windows in response to other manufacturers, who developed new, improved operating systems that could have threatened Microsoft's hold on the market. Xerox had created a new and improved operating system with the first graphical user interface, or GUI (pronounced "gooey"). Apple Computer Corp. soon created its own version for one of its computers, which ultimately failed. But then Apple also used the GUI software on the Macintosh, which was introduced in 1984 to wild acclaim. Previous operating systems were all based on text. They relied on a series of complicated commands that had to be entered using a variety of keys simultaneously, like the control, alt, and function keys. It was difficult for non-experts to master. The Mac's unique operating system allowed users to point a mouse and click at easily identifiable icons, or pictures. It was so simple and intuitively obvious that it became the first computer for everyday people with no electronic knowledge or experience. It was sure to overpower MS-DOS and other text-based operating systems.

Microsoft came up with its own version of a graphical user interface in Windows 1.0, which was finally released in 1985, two years after it was announced. It wasn't very powerful, and there were still many bugs to work out. With that first release, though, Windows started down the road toward becoming the most popular user interface in computer history. "Moving from character-based DOS to Windows with its graphical user interface was an enormous challenge back in the early 1980s," Stuart Glascock wrote in *Computer Reseller News*. "Programmers logged long hours, worked with feeble hardware, designed previously unimaginable new drivers, and created a new paradigm. In effect, they dragged, pushed, pulled, and cajoled DOS into the GUI age for PCs. When Windows 1.0 shipped in November 1985, it represented a gigantic step toward the still-elusive goal of computer programmers everywhere. Instead of having to decipher the strange language of DOS, Windows gave users a GUI. That is a fancy term for simplicity, something visual, something requiring minimal hand-eye coordination to manage."

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After that first Windows introduction in 1985, many upgrades would follow. Sales took off in 1990 with Windows 3.0, which sold 4 million copies and soon dominated the market. That year, company sales reached $1 bil-

Gates holds up Microsoft Bookshelf, a CD-ROM that holds all the information in the books pictured, 1987.

lion. Later major upgrades included Windows 3.1 in 1992, Windows 95 in 1995, and Windows 98 in 1998, all for office and home use. There were also Windows systems created specifically for networking, for servers, and for corporate use. Throughout the years, with each upgrade, Microsoft provided more power, more computing capabilities, more features, and more ease of use. "Microsoft's eventual success with Windows," Tom Duffy wrote in *Computerworld* magazine, "secured its place as the dominant software company it is today."

For Microsoft, though, their dominance of the market for the PC operating system had even broader implications. For different computers to be able to use similar software, for different computers to be able to communicate, they all must run on the same standards. And ultimately, those standards have been set by the Microsoft operating system. As Philip Elmer-DeWitt wrote in *Time* magazine, "[Gates] understands as few do that the great lever of wealth and power in the digital age is not hardware or even software but control over the standards to which others must adhere. Today on nine of every ten personal computers, those standards are Microsoft's." This control of the standards on the computer's operating system has had huge implications not only for Microsoft's control of the operating system, but also for its creation of applications software.

APPLICATIONS SOFTWARE

Throughout the same time that Gates and Microsoft were creating new generations of Windows, they were also developing applications software for the personal computer that would run on the Windows operating system. And they had a distinct advantage. Because Microsoft also created the operating system, the company programmers had access to all the hidden details. When writing software to run on Windows, they were able to take advantage of their knowledge of the inner workings of Windows to ensure that the applications software would run seamlessly, with the operating system and with other Microsoft applications software. Other companies also created applications software, of course, that could run on IBM-compatible PCs. But in many cases the software created by Microsoft was integrated more seamlessly into the operating system, leading to the company's dominance in many other areas as well.

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Some of the company's best-selling applications programs include Word, for doing word processing; Excel, for generating spreadsheets; Access, for building and maintaining databases; PowerPoint, for creating presentations; Project, for planning and tracking big projects; FrontPage, for creating Web sites; Internet Explorer, for accessing the World Wide Web; and others. In addition, there's Encarta, an electronic encyclopedia. Back in 1990 the company began to bundle together some of these best-selling programs as a suite. Today, the company offers these titles bundled together in several different combinations. Now known as Office 2000, the Microsoft Office family of suites was expected to bring in revenues of almost $8 billion in 2000 alone.

CORPORATE CULTURE AND BUSINESS PRACTICES

Gates cites several features as hallmarks of the Microsoft corporate culture. One is an entrepreneurial approach to leadership, with simple lines of authority, employees organized into small teams with tight budgets, and simple, non-ostentatious offices. "We cannot think like a big company or we are dead," Gates has said. He also emphasizes the importance of working with smart people. "Hiring smart people has been the single most important thing we've done as a company from the very beginning. Paul Allen and I started out hiring our friends, always with an eye to people who had a lot of passion for what they were doing and who were very, very bright."

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> *According to Walter Isaacson in* Time, *"[Gates's] success stems from his personality: an awesome and at times frightening blend of brilliance, drive, competitiveness, and personal intensity. So too does Microsoft's."*
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Yet many Microsoft watchers point to other parts of the corporate climate. One key element has been the company's ability to identify and respond to trends early on, according to business writer Michael J. Martinez. "Company insiders and outside observers agree [that a large] part of Microsoft's success has been an uncanny grasp of the marketplace," Martinez says, "always looking for the 'next big thing' and jumping on it with an aggressive, take-no-prisoners mentality." Other observers see clear links between Gates's personality, the environment at Microsoft, and the way the company conducts business. "The personality of Bill Gates determines the culture of Microsoft," says his close colleague and Microsoft executive Nathan Myhrvold. According to Walter Isaacson in *Time*, "[Gates's] success stems from his personality: an awesome and at times frightening blend of brilliance, drive, competitiveness, and personal intensity. So too does Microsoft's." Gates can be both argumentative and combative, and he's known for yelling at both his closest colleagues and other Microsoft employees. His favorite phrase is "That's the stupidest thing I've every heard." He's also very competitive, a trait that dictates both his personal relationships and the way the company approaches business decisions. Many industry observers feel that he has taken his aggressive approach into the marketplace, using it to defeat all possible competitors.

LEGAL BATTLES

During the 1990s, Microsoft found itself the subject of several legal challenges. In 1998, Microsoft was sued by the U.S. Justice Department for unfair business practices. The suit said that by including the Internet Explorer web browser on the Windows 98 operating system, Microsoft did not allow other Internet browsers, such as Netscape Navigator, to compete fairly. Because Windows is used on 90% of all PCs, Microsoft was said to have an unfair advantage. The suit alleged that the company's business practices pressured PC manufacturers to use only Microsoft products. The legal issue was whether Microsoft had violated federal anti-trust laws, which protect business competition by outlawing price fixing and by prohibiting companies from using their economic power to create monopolies, where a single company has exclusive control of a product. The case against Microsoft was brought by the Justice Department on behalf of Netscape and other competitors, who alleged that Microsoft had engaged in monopolistic practices to drive them out of business.

Gates testified during the trial, providing a videotaped deposition that was played in court. Legal observers said he appeared either combative or bored and that he avoided answering questions. The judge noted that Gates was not "particularly responsive," and some analysts said that his testimony was a turning point in the trial because it weakened the credibility of the company's case.

In June 2000, the trial concluded when Microsoft was found to be in violation of U.S. anti-trust laws. Federal judge Michael Penfield Jackson ruled that Microsoft must be broken up into two companies. One company would center on Windows technology, the operating system used on most of the personal computers in the world. The other company would center on the rest of the Microsoft products, the applications software like Word, Excel, Access, PowerPoint, Internet Explorer, and others. In his ruling, the judge said that he found Microsoft to be "untrustworthy," and he said that "credible evidence" existed that indicated that Microsoft continued to use its monopolistic strength to damage rivals. The judgment also imposed restrictions on how Microsoft could conduct business. For example, it required that Microsoft set up a pricing schedule for Windows, and it also prevented the company from setting limits on how a computer manufacturer can place Windows on the machines they sell.

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"Hiring smart people has been the single most important thing we've done as a company from the very beginning. Paul Allen and I started out hiring our friends, always with an eye to people who had a lot of passion for what they were doing and who were very, very bright."

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After Judge Jackson's ruling, Gates immediately condemned it as "an unwarranted and unjustified intrusion," and Microsoft promptly filed a legal appeal. The case will be heard in the federal appeals court beginning in February 2001, and it will probably go on to the Supreme Court. The final disposition of the anti-trust case against Microsoft may not be decided for a few more years.

WHAT'S NEXT FOR GATES AND MICROSOFT

At this point, the future for Gates and Microsoft — as well as the personal computer industry as a whole — is unclear. About 25 years ago, when Microsoft started out, the idea of a personal computer on every desk was unimaginable. Ten years ago, many people couldn't imagine that they had ever worked without one. Today, many people can barely remember life before instant access to the Internet and the World Wide Web. And many other technological devices are quickly becoming equally pervasive, like cellular phones with wireless Internet access, handheld personal digital assistants (PDAs), bedside email systems, video game consoles with Internet access, and more. As these devices become more pervasive, some people are becoming less reliant on the personal computer. Are these devices the wave of the future? Perhaps someday, desktop PCs will seem as archaic as the Altair 8800 would today.

These are the types of issues that Gates is working on currently. In January 2000, he resigned his position as CEO of Microsoft to become the company's chief technology architect. In that capacity, he is taking a more hands-on approach to overseeing the company's work on future technology. Of course, Microsoft's current dominance in the industry is based on its control of Windows — the PC operating system — and much of the software that's based on it. But it's unclear whether the PC will continue to dominate in the future the way it has for the last 20 years. If not, the value of Windows could begin to slip. So in his new role as chief technology architect, Gates is trying to foresee the direction of future technology, so Microsoft can lead the pack.

One such development they've been working on is Microsoft.Net (pronounced dot net). First announced in June 2000 but not scheduled to be released for about two more years, .Net is a new type of software interface. It would replace most of Microsoft's current software with a subscription-based service on the Internet. Those services would make it easy to access and use information online. For example, when planning a trip, you could integrate your personal calendar and your finances with airline Web sites with flight information, travel Web sites with hotel and restaurant information, weather Web sites with weather information at your destination, and more. At this point, Gates and Microsoft are betting that the new service Microsoft.Net will become a dominant force in the new emerging post-PC world.

HOME AND FAMILY

Gates lives with his wife Melinda, a former Microsoft executive, near Seattle, Washington. They have two children, Jennifer Katherine, born in 1996, and Rory, born in 1999. They live in a 40,000 square foot house on Lake Washington that cost approximately $75 million to build. The house has some pretty amazing features. The 11,500 foot family wing, in addition

Bill and Melinda Gates announce the inaugural class of the Gates Millennium Scholars Program, June 2000.

to the family living area, boasts a 17 x 60 foot swimming pool, 2,500-square-foot exercise facility, sauna and steam room, locker room, and trampoline room with 20-foot-high ceilings. There is also a theater, library, formal dining room, conference facilities, 20-seat theater with popcorn maker, and reception hall that can seat 150 people for dinner. The grounds include a guest house, underground garage, boat house, gate house, and stream and wetland estuary stocked with salmon and trout.

PHILANTHROPY

In recent years, Gates has become involved in charitable giving. In 1997 he created a foundation, called the Bill and Melinda Gates Foundation, which he has endowed with $22 billion. The foundation, which will spend $1 billion each year, is the richest foundation in the world. At this point, Gates's main interests for philanthropic giving are libraries, schools, and global public health. "People have only begun to see the impact of his wealth on education, medicine, poverty, and social causes, a legacy that may overshadow his technological contributions," said Paul Andrews, the author of a biography on Gates. So far, the foundation has pledged $1 billion to create the Gates Millennium Scholars Program, a minority scholarship to close the racial gap in higher education. The grant program, which will be managed by the United Negro College Fund, will give undergraduate scholarships to 1,000 financially needy students each year. Other recent gifts include $400 million on global health initiatives and $200 million to wire libraries for the Internet in low-income communities.

When asked about his plans for the future, Gates often says that he plans to continue to work at Microsoft for another ten years. But he has also indicated that at some point he will be spending more time giving away money than making it. "Melinda and I have been spending more time working with our foundation as it engages some interesting projects. I know I'll spend more time on that later on. For now, though, Microsoft is my career, and I think I have about the best job in the world."

> *"People have only begun to see the impact of his wealth on education, medicine, poverty, and social causes, a legacy that may overshadow his technological contributions," said Paul Andrews, the author of a biography on Gates.*

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ADDRESS

Microsoft Corporation
1 Microsoft Way
Redmond, WA 98052

WORLD WIDE WEB SITE

http://www.microsoft.com

Laura Groppe 1964-

American Computer Software Developer and Internet Entrepreneur
Founder and President of Girl Games

BIRTH

Laura Groppe was born in 1964 in Houston, Texas. She was the youngest of five children born to Henry Groppe, who owns an oil and gas consulting firm, and his wife Carol. Groppe is pronounced GROP-ee, to rhyme with "floppy."

YOUTH AND EDUCATION

Groppe was raised in a wealthy family in Hedwig Village, an exclusive suburb of Houston. She proved to be an independent-minded and headstrong child from an early age. "I've always been very, very independent," she recalled. "In first grade, when I was finished with my work, I would gather my things and go sit at the teacher's desk until it was time to go home. Whether that was four hours away or four minutes away."

Groppe graduated from Memorial High School in the Houston area in 1981. She then chose to attend Sweet Briar College, an all-women's school in Virginia. "There were other women there with the same sensibility and drive," she explained. She earned a bachelor's degree in philosophy in 1985.

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CAREER HIGHLIGHTS

Successful Producer of Independent Films

After graduating from college, Groppe spent 18 months teaching English and aerobics in Tokyo, Japan. She then traveled and worked at odd jobs for a while before finally landing in Hollywood, California. Groppe immediately made an impact in Hollywood as a producer of independent films and music videos. "I opted to always take smaller projects in films," she noted. "You have more freedom to do creative things with independent films." Her greatest success as a filmmaker came in 1992, when she won an Academy Award for Best Short Film as the producer of "Session Man." This 30-minute film tells the story of a guitar player who waits many years for his big break. He finally gets a chance to play with a popular rock band, but only for one night.

In 1994, Groppe co-produced a film called "Suture" that won an award for Best Cinematography at the Sundance Film Festival, a prestigious showplace for new independent films. She also produced music videos for such musicians as k.d. lang, Smashing Pumpkins, and R.E.M. She co-produced the video for R.E.M.'s song "Everybody Hurts," for which she won four MTV music awards. Despite her successful career as a producer, however,

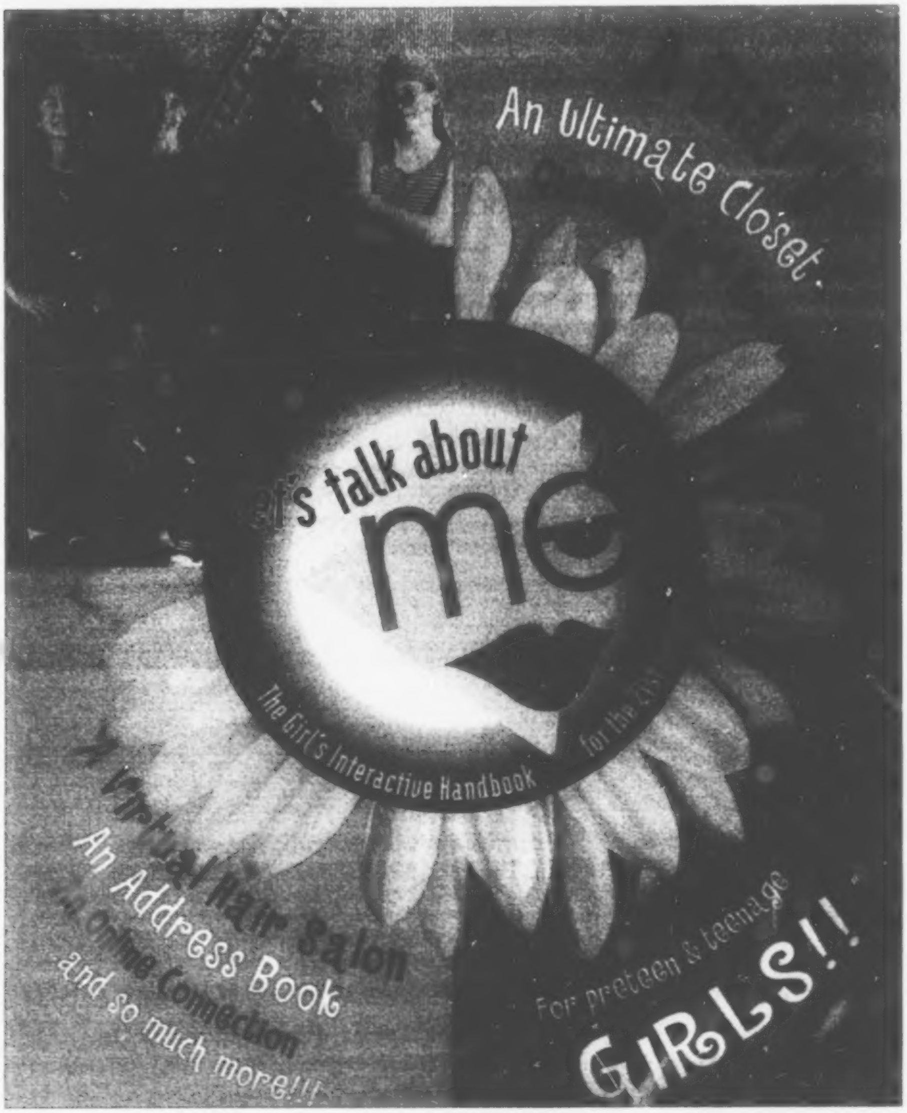
my body
my body
my body

Groppe felt burned out after seven years in Hollywood. "I knew I didn't want to do film for the rest of my life," she stated. "I felt like I either had to move up a level or get out altogether."

Ready to make a career change, Groppe began thinking about the future of the entertainment industry. "I looked at the next generation of entertainment and what that entailed, and that's clearly interactive entertainment," she explained. "It seemed clear that to explore that exponential growth was the way to go." She recalled watching the video for Madonna's song "I Remember"—in which the singer plays three different roles—and wondering, "What if you could do something interactive, where you could play those roles, see what they're seeing?" She soon decided to move back to Houston and become involved in the growing industry of interactive computer games.

Deciding to Create Computer Games

Interestingly enough, Groppe was "computer-phobic" during most of her time in Hollywood. In fact, she was once passed over for a film project because she lacked computer skills. But that only convinced her to buy a computer and teach herself how to use it. By the time she returned to


An Ultimate Closet.
et's talk about
me
The Girl's Interactive Handbook for the
A Virtual Hair Salon
An Address Book
An Online Connection
and so much more!!!
For preteen & teenage
GIRLS!!

Houston in 1994, she was well-versed in the basics of computers, software, and the Internet.

When shopping for interactive computer games, Groppe noticed that most products were obviously aimed at boys and men. "In 1994, you would walk down the aisle at Comp USA, and it was just miles and miles of black boxes with dragons and gold writing," she noted. Groppe looked more closely and found that the ratio of males to females on computer game boxes was 13 to 1. She also discovered that when female characters did appear in top-

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selling video games, they were treated as victims one-third of the time. She could not find any interactive games that would appeal to women or girls. "There was nothing—not one thing—that I would have shelled out $25 for in the way of an entertainment product on the computer," she stated. "I thought: I'm willing to be entertained, and I'm willing to have this platform be my entertainment, but there's nothing out there for me."

Groppe saw the lack of computer games and software aimed at girls as a potential business opportunity. She decided to do more extensive research in order to uncover what girls wanted in an interactive game. She started out by visiting local junior highs and high schools and sitting in on classes. "I wanted to know everything," she recalled. "I wanted to know what one girl had written on a note she was passing to the other girl in math class." As her research progressed, she received a grant from the National Science Foundation and was able to take advantage of the resources of Rice University.

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Computer Games for Teenaged Girls

Through her studies, Groppe learned a number of interesting things about teenaged girls and their preferences in interactive computer games and other forms of entertainment. "From those focus groups and research projects, we learned a few absolutes when it comes to designing computer games for girls," she related. "One that surprised me is that girls won't read directions. So, on the design level, your product has to be so intuitive that players can know immediately what they need to do next. Another thing we learned is that girls tend to migrate together in front of the computer and play the games together."

Unlike boys—who tended to like fantasy worlds, action, and competition—girls tended to like realistic games that focused on social relationships and problem-solving. "Girls want to play games that incorporate aspects of their lives and involve social interaction," Groppe explained. "They like the action and adrenaline [of boys' games] at first, but after a while, they don't get the point. A lot of people in the software industry think if you just put in a female protagonist, it's going to appeal to girls. But if it's a poorly designed game, it doesn't matter if it's a male or female protagonist."

Groppe's research disputed the idea that girls were simply not interested in computer games. In fact, she found that the number of female game players was increasing at a rate of 25 percent per year. In addition, 85 percent of girls indicated that they would play more computer games if there was software directed at their interests. Finally, Groppe learned that girls had plenty of money to spend on computer games. The 19 million teenaged girls in the United States spent over $50 billion of their own money each year, much of it on entertainment.

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Starting Her Own Company

In May 1994 Groppe used the results of her research to start her own computer games company, called Girl Games. She opened an office in Houston and decorated it in a way that would appeal to teenaged girls—with beanbag chairs, inflatable furniture, and posters of attractive young men. She then hired a team of mostly female software designers, developers, artists, and writers.

Groppe used her own savings to finance the company's first year of operations, then launched a search for investors. She ended up cutting her waist-length hair so that she would fit the image of a successful business woman. "My father said people might take me a little more seriously if I didn't look like a surfer rat," she explained. Although she had little experience as an entrepreneur, Groppe was able to use some of the skills she had developed as a film producer in starting her company. "As it turns out, it was really a function of knowing how to manage creative people, and I

Digital Diva
How to Create Your Own Magazine
ACTIVISION
Teen

knew how to think about a product and how all the money has to go toward making it a good product," she noted. Toward the end of 1995, Groppe moved the Girl Games offices to Austin, which was rapidly becoming known as the technology center of Texas.

The mission of the company was to create computer software and interactive games specifically aimed at girls between the ages of seven and 17. Groppe hoped that Girl Games products would help girls remain interested in computers and technology into their teen years, so that they would be more likely to pursue technical careers as adults. "You look around, in our current information age, and you see that girls enter puberty at an earlier time and the world confronts them with different situations than we faced when I was 13. Studies show that as a girl's body changes, that's when her self-esteem begins to drop," she explained. "These are the girls we're losing, when they go into ninth grade and they start dropping out of math and science like crazy. . . . The whole basis of this company is to get girls to incorporate technology in their lives, to get them through to the next century, so they can be competitive."

As Girl Games began developing interactive games for girls, Groppe and her staff continued to work closely with real teenagers to gather their input. Unlike some software companies, which only brought kids in to test finished products, Girl Games made a point of involving girls in all phases of product development. "We do international focus groups online. We do national focus groups online. We're in real-time communication every week with these girls," Groppe noted. "We shop with them. We go to their slumber parties. We hang out with them. I mean, it's my job to really be a 14-year-old girl all over again."

Groppe emphasized that she wanted to make products that would not only sell, but that would also encourage girls to create, think, and learn. She knew that without interesting computer games and activities, girls would likely turn to other forms of entertainment. "My competition is friends, the mall, and the telephone," she stated. "I'm battling for time.

Girls use technology as it's relevant to their world." Some people claimed that, with its focus on girls, Girl Games was leaving boys out. But Groppe disagreed: "I don't feel like we're excluding anybody. I'm not in the capacity to design for boys. I feel they're already being attended to, and they will continue to be attended to. It's not that we're excluding boys; we're addressing girls."

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Developing Popular CD-ROM Games

Girl Games introduced its first product, a series of CD-ROMs called *Let's Talk about ME,* in the summer of 1996. Each CD-ROM in the series centered around a different theme, like sports, fashion, health, and relationships. Within each theme, there were features such as a scrapbook, an interactive diary, interviews with mentors, and a look into the future. One feature allowed girls to take a personality quiz to see if their profile matched California Senator Dianne Feinstein, African-American poet and author Maya Angelou, or other successful women in various fields. *Let's Talk about ME* had the look of a popular magazine and was described as "a handbook for growing up."

"This product will give girls the information they need to contend with adolescence today. The interactive world can exercise a girl's power and can encourage her to make choices, make decisions, and let her know that she is something important," Groppe explained. "Of course, we have the ultimate fashion closet and the hair master 2000, where you can try on all different kinds of hairdos. So it's a nice balance of the more stereotypical preferences of girls with things that revolve around being a preteen and a teen today in the '90s."

Groppe signed a deal with Simon and Schuster Interactive to publish and promote the CD-ROMs and related products. *Let's Talk about ME* became a best-seller and was named among the best children's software on the market by several leading magazines. "The reaction to it is more positive than I

Teen
Digital Diva II
Compatibility Tests
Create Your Own Magazine
Mystical Makeovers
Horoscopes, Fashion, Quizmaker and More
FREE
CD SAMPLER INSIDE
ACTIVISION
GIRL GAMES
TEEN
T
ESRB

could have dreamed," Groppe noted. "I knew it would succeed, but I could not believe how hungry they were for this." Groppe received positive feedback everywhere she went to promote the product. "After my demonstration in Chicago, this little 12-year-old with big brown eyes came up to me and said, 'I just wanted to thank you for starting your company because if you hadn't, I wouldn't have anything to play with on my computer,'" she recalled, "and I thought I would just weep, because this is what it's all about for us in the company."

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Girl Games' next round of CD-ROM products included interactive games based on the popular TV shows *Sabrina the Teenage Witch* and *Clueless*. The company also collaborated with *Teen* magazine to create *Teen Digital Diva* and *Teen Digital Diva II*. These product allow girls to create their own version of *Teen* magazine, complete with virtual makeovers, the latest fashions, original articles, and customized personality quizzes. They feature cool characters, colorful animation, and hip music.

Creating Online Products

In 1997, Girl Games introduced a Web site for girls called Planet Girl, at www.planetgirl.com. Groppe and her team of designers envisioned the site as an online community full of content of interest to girls. "Currently girls are using the Internet as a socialization tool and as a communication tool and a device—an extension of self-expression," she noted. "So we're seeing a lot of girls building their own Web sites and we, of course, link all of them together on planetgirl.com. I think that technology is now demonstrating that it can be an extension of the girl's self and her growth and development, and that's really what the girls are embracing as opposed to multi-player, shoot-them-up games and that kind of thing."

The Planet Girl site includes areas focusing on relationships, development, style, and common problems of adolescence. There is also a private, members-only area called the Tiara Club Lounge which features musical downloads and interviews with celebrities. The site allows girls to specify their interests and be hooked up with pen pals with similar tastes. "Primarily, I am in the business of building a community that is safe, that is hip, and that is cool—where girls can go, hang out, and meet other girls like themselves who are digital, who are smart, and who are savvy," Groppe explained.

Future Plans for Girl Games

By 2000, Girl Games was divided into three business units: Brand Studio, Planet Girl, and Girl Games Research Labs. The first area of Girl Games is the Brand Studio, which has continued to develop interactive computer games and other entertainment products for girls. The second area of Girl Games is the Planet Girl online community. The main emphasis of this section of the company has been developing online brands to expand into consumer products. For example, the character Indygirl, who appeared in an extreme sports feature on the Planet Girl Web site, also became a skateboard brand.

The third area, Girl Games Research Labs, has become the company's primary focus in recent years. This area has continued many of the research efforts that Groppe undertook before founding the company, including focus groups, panel discussions, and school visits. Known for its research and analytical work, it has turned into a respected authority on the consumer preferences of teenaged girls. Today, this section of Girl Games advises many large companies—such as Motorola, Nike, Hallmark, Mattel, Johnson & Johnson, Warner Brothers, 20th Century Fox, and others in the entertainment industry—about the tastes, spending patterns, and high-tech habits of teenage girls. Girl Games recently moved its offices from Austin, Texas, to the Los Angeles area to be closer to many of these clients.

Another part of Groppe's strategy for expanding her company has involved forming alliances with various other companies for promotional purposes. For example, Girl Games set up cyberlounges in Macy's stores to collect teen feedback on the Planet Girl Web site, and now the company is redesigning the site. The company also made a deal with Sony Pictures Entertainment to promote movies online in exchange for exposure of Girl Games products. In addition, it's currently producing studies on such topics as girls and wireless devices, personal digital assistants, and integrated personal communication devices. "We reinvent our business model almost annually, if not twice a year," Groppe stated. "We are dealing with probably the most fickle demographic [teenaged girls], and we are in the fastest changing industry that you can be in."

HOME AND FAMILY

Groppe has never been married and does not have children of her own. Instead, she depends on her young nieces and the participants in Girl Games' focus groups to keep her up-to-date on what teens think is cool. She also claims that she still feels like a teenager herself. "I'm incredibly immature, and I have no interest in being a responsible adult," she noted.

"At one point my mother did say, you know, thank goodness you found a career that would justify your lifestyle."

AWARDS AND HONORS

Academy Award: 1992, for "Session Man," for Best Short Film
Sundance Film Festival Award: 1994, for "Suture," for Best Cinematography

FURTHER READING

Books

Who's Who of American Women, 2000-2001

Periodicals

Austin American-Statesman, Dec. 28, 1995, p.30; June 30, 2000, p.H1
Austin Business Journal, Jan. 26, 1996, p.21
Austin Chronicle Screens (online edition), Dec. 17, 1999
Charleston Gazette Mail, July 14, 1995, p.E2
Chicago Tribune, Aug. 24, 1997, Womannews Section, p.1
Forbes, Feb. 9, 1998, p.72
Houston Chronicle, Aug. 3, 1995, Houston Section, p.1
Los Angeles Times, May 27, 1996, p.D1; Apr. 12, 2000, p.C1
New York Times, June 23, 1997, p.D3
People, Oct. 21, 1996, p.106
Texas Monthly, Jan. 1996, p.25
U.S. News and World Report, Mar. 18, 1996, p.69

ADDRESS

Girl Games
11766 Wilshire Blvd.
Suite 1550
Los Angeles, CA 90025

WORLD WIDE WEB SITE

http://www.girlgamesinc.com

RETROSPECTIVE

Grace Murray Hopper 1906-1992

American Computer Programming Pioneer
Helped Develop the First Compiler for Modern
Computers and the COBOL Programming Language

BIRTH

Grace Murray Hopper was born Grace Brewster Murray on December 9, 1906, in New York, New York. Her father, Walter Fletcher Murray, worked in the insurance business, while her mother, Mary Campbell (Van Horne) Murray, was a homemaker. Grace had a younger sister, Mary, and a younger brother, Roger.

YOUTH

Hopper grew up in a wealthy family that placed a high value on education. In those days, women generally were not expected to attend college or pursue a career. But Hopper's parents encouraged both their daughters and their son to do well in school so that they would have every opportunity to succeed in life. Throughout Hopper's childhood, her mother provided a good role model for her. Even though Mary Murray did not work outside the home, she loved mathematics and handled all the household finances. She always strove to maintain her independence since Hopper's father, Walter Murray, had health problems that eventually resulted in the amputation of both his legs.

> *When Hopper was seven years old, she took apart every alarm clock at her family's summer home in an attempt to figure out how they worked. "What had happened was that I'd taken the first one apart and I couldn't get it together so I opened the next one. I ended up with all seven of them apart. After that I was restricted to one clock."*

As a young girl, Hopper enjoyed playing the piano and reading—especially books about travel and adventure. But what fascinated her most was machinery and gadgets. Her favorite toy was a construction set with working elevators. When she was seven years old, she took apart every alarm clock at her family's summer home in Wolfeboro, New Hampshire, in an attempt to figure out how they worked. "What had happened was that I'd taken the first one apart and I couldn't get it together so I opened the next one," she remembered. "I ended up with all seven of them apart. After that I was restricted to one clock."

Hopper learned about the practical uses of mathematics while accompanying her grandfather on his jobs as a surveyor. She would help him take detailed measurements that were used to plan the layout of the streets, sidewalks, and buildings in the Bronx section of New York City. Hopper recalled that it was a combination of many factors that led her to pursue a career in mathematics and computer science: "My mother's very great interest in mathematics and my father's, a house full of books, a constant interest in learning, an early interest in reading, and insatiable curiosity . . . these were a primary influence all the way along."

EDUCATION

Hopper attended private schools in New York City, including the Graham School and the Schoonmakers School. She was an excellent student and never failed to meet her parents' high expectations. She also participated in basketball, water polo, and field hockey. At the age of 17, Hopper decided that she wanted to study mathematics at Vassar College, a prestigious women's school in New York. She was deeply disappointed when she failed the Latin portion of the Vassar entrance exam and was forced to wait a year to begin college. During this time, she enrolled at Hartridge School in New Jersey, where she sang with the Glee Club and acted in school plays.

After completing a year of college preparation at Hartridge, Hopper passed the entrance exam and enrolled at Vassar in 1924. She majored in math and physics and continued to excel in her studies, earning a place in the Phi Beta Kappa national honor society. At one point, a professor asked her to tutor a fellow student. Hopper soon found that she enjoyed teaching and sharing her love of math and science with others. She earned her bachelor's degree from Vassar in 1928. That summer, she met Vincent Hopper, who was an English professor at New York University. They dated while she continued her study of mathematics at Yale University in Connecticut. They were married in 1930, the same year she earned her master's degree from Yale.

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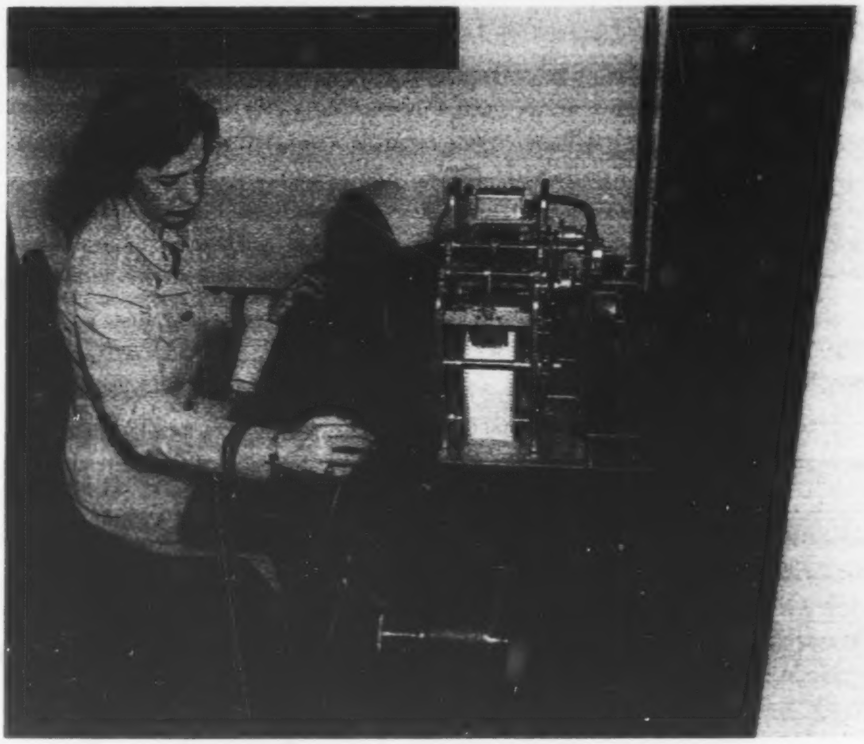
For the next few years, Hopper taught mathematics at Vassar while also working toward a doctorate degree at Yale. She became known for her original teaching methods during these years. For example, in order to help her students understand the concept of probability (the mathematical likelihood that a certain event will occur), she had them play games of chance like cards and dice. Her unusual approach helped her students understand math and its importance in everyday life. In 1934, Hopper earned her Ph.D. in mathematics from Yale. This was a rare accomplishment for anyone in those days, but it was practically unheard of for a woman.



Hopper working on a manual tape punch, an early computer.

CAREER HIGHLIGHTS

Joining the U.S. Navy

Hopper continued teaching at Vassar until 1944. At this time, the United States was involved in fighting World War II, and Hopper became determined to contribute to the war effort. She decided to join the U.S. Navy through a program called Women Accepted for Volunteer Emergency Service, or WAVES. The idea behind the WAVES program was to train women to take jobs in Navy offices in the United States so that more men would be available to fight overseas. Hopper explained that she wanted to join the Navy "because there was a war on and everybody was going into something. . . . Besides, I love the color blue."

The first time Hopper tried to enlist in WAVES, her application was rejected. The Navy claimed that she was too old (at 36) and her weight was too low (at 105 pounds) for military service. They also said that she would be more valuable to the country by continuing her work as a math teacher, giving the next generation of Americans the technical background they would need in the armed services. But Hopper refused to take no for an answer. She took a leave of absence from her teaching job and reapplied to the WAVES program, and this time she was accepted. After receiving training at Midshipman's School and graduating at the top of her class, Hopper was assigned to a special Navy program at Harvard University.

Programming One of the First Computers Ever Developed

Upon arriving at Harvard, Hopper learned that she would be working with a team of other scientists and mathematicians to program the Mark I, which was one of the first computers ever developed. The Mark I was eight feet tall and 50 feet long, so it took up most of a large room. It contained thousands of small electromechanical switches and blinking lights. Although she did not know much about computers, Hopper found the machine fascinating. "It was the fanciest gadget I'd ever seen," she recalled. "I had to find out how it worked."

> *Hopper started working on the Mark I, one of the first computers ever developed. Although she did not know much about computers, Hopper found the machine fascinating. "It was the fanciest gadget I'd ever seen," she recalled. "I had to find out how it worked."*

Hopper's commanding officer on this special Navy project was Howard Aiken, who had helped develop the Mark I system. Hopper and the rest of Aiken's team worked on programming the Mark I for military applications. For example, American soldiers had to perform complicated mathematical calculations in order to aim modern weapons like self-propelled rockets. They had to compute firing angles — taking rapidly changing factors like wind and weather into account — that would enable the weapons to hit specific targets. This process was slow and not always accurate. So the Navy asked Aiken and his team to program the Mark I to help compute firing angles.

Hopper used her math skills to identify the formulas needed to fire different weapons accurately. Then she rewrote these formulas as a series of steps or instructions that the computer could follow. Next, she had to translate the steps into a numeric code that the computer could understand. Then she converted the computer code into a series of holes punched into paper cards or tape. These cards were used to feed instructions into the Mark I. Although the process of programming the computer was very time-consuming, the Mark I could perform three calculations per second once it was programmed. This meant that the machine could perform work that would have taken a person six months in only one day. In addition, the Mark I did not make mistakes and never got tired.

The Mark I project kept Hopper very busy. In fact, she often slept in her office as the team worked to keep the machine functioning 24 hours per day. But she enjoyed the challenge of applying her math skills to programming one of the world's first computers. "I'd never thought of going into computer work because there weren't any computers to go into," she explained. "In the 1940s, you know, you could have put all the computer people in the country into one room."

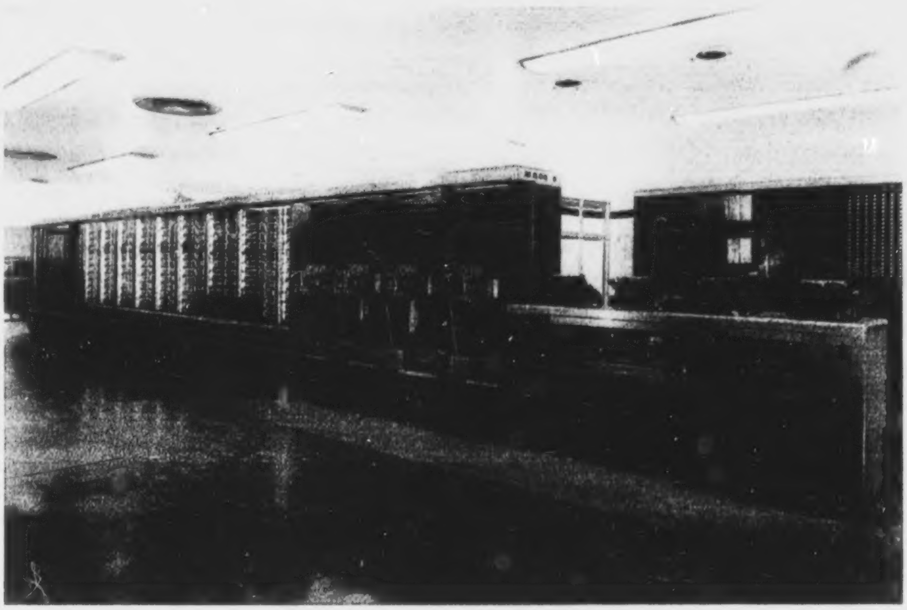
"I'd never thought of going into computer work because there weren't any computers to go into," she explained. "In the 1940s, you know, you could have put all the computer people in the country into one room."

Finding the First Computer Bug

In 1945, Hopper joined a new team that was working to develop the Mark II, a more advanced computer which was expected to be five times faster than the Mark I. During this time, she was involved in an incident that has become legendary in the history of computer programming. Hopper's team became frustrated one day because the Mark II suddenly began malfunctioning. "Things were going badly, there was something wrong in one of the circuits of the long, glass-enclosed computer," she remembered. "Finally, someone located the trouble spot and, using ordinary tweezers, removed the problem, a two-inch moth." The moth had flown into the computer and been squished between two parts of a switch, breaking the electrical circuit. Hopper taped the dead moth into her logbook with a note saying that her team had "debugged" the computer. This was one of the first times the term "bug" was used to mean a problem within a computer. "From then on, when anything went wrong with a computer, we said it had bugs in it," Hopper explained.

Developing the First Compiler for Modern Computers

Hopper divorced her husband in 1945, but she continued to be known by her married name. She remained in the U.S. Navy Reserves after World War II ended and kept working on computer projects at Harvard for the next few years. Over time, however, Hopper decided that her main priority



A view of a laboratory containing the massive IBM Mark I computer.

was expanding the usefulness of computers beyond military applications. She wanted to write programs that would help people use computers in businesses and factories. In order to do research into these potential uses for computers, Hopper took a job with Eckert-Mauchly Computer Corporation in Philadelphia, Pennsylvania, in 1949.

Eckert-Mauchly, which later became a division of Remington Rand, planned to build a computer system called the UNIVAC I. At eight feet tall and 14 feet long, it would be the smallest computer ever built up to that time. UNIVAC I would also be 20 times faster than the Mark II and feature internal memory, so programmers could store instructions inside the computer rather than on punch cards or magnetic tape. Hopper spent two years working with other computer experts to develop UNIVAC I. "We used to say that if UNIVAC I didn't work, we were going to throw it out one side of the factory, which was a junkyard, and we were going to jump out the other side, which was a cemetery," she remembered.

By 1951, the UNIVAC I was working. Hopper then turned her attention to helping the computer understand and use subroutines, or groups of instructions that programmers could insert into the computer's memory once and then reuse many times. For example, a certain subroutine might involve adding two numbers and storing the result. Teaching the computer

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to use subroutines would save the programmers a great deal of time because they would not have to copy the same instructions over and over again. "There stood a gadget whose whole purpose was to copy things accurately and do addition," she noted. "And it therefore seemed sensible, instead of having programmers copy the subroutines, to have the computer copy the subroutines."

Once she succeeded in teaching UNIVAC I to store and access subroutines, Hopper took her groundbreaking work a step further. Up to this point, programmers could only communicate instructions to computers using complicated strings of numeric codes. But Hopper knew that alphabetic characters and words were easier for people to use, so she wanted to find a way to make the computer understand them. She developed a device called a compiler, which took a programmer's instructions written in symbolic language and translated them into numeric computer codes. The computer then used these codes to access an internal library of subroutines. Basically, Hopper's compiler eliminated the need for computer programmers to write programs in complicated computer language. This reduced the number of programming mistakes and opened the door for non-experts to begin working with computers.

By 1952, Hopper was ready to introduce her invention, the A-0 compiler, to the world. But no one believed it was possible to program a computer to understand language and perform complicated mathematical equations from memory. "I had a running compiler, and nobody would touch it because, they carefully told me, computers could only do arithmetic; they could not do programs," Hopper recalled. "It was a selling job to get people to try it. I think with any new idea, because people are allergic to change, you have to get out and sell the idea." In the meantime, Hopper continued her involvement with the U.S. Navy Reserves. She was promoted to the rank of lieutenant commander in 1952.

Helping Create the COBOL Programming Language

Hopper still hoped to make computers more useful and accessible to businesses. She realized that many people resisted introducing computers to their businesses because they did not feel qualified to do complicated mathematical programming. So she began working to create a new programming language that would enable people to communicate with computers using familiar business-oriented terms, like "count" and "display." She also developed an improved compiler that would access specific subroutines based on those instructions. Hopper's new programming language became known as FLOW-MATIC.

Before long, other programmers followed Hopper's lead and began developing a number of specialized computer languages for different purposes. As these programming languages became more widely available, many large businesses began using computers. But it soon became clear that the rapid growth of programming languages would prevent different business computers from working together. So the U.S. government formed a committee of computer experts to create a standardized programming language for business use. In 1959, this committee developed a new language called COBOL, or COmmon Business Oriented Language. Hopper acted as an advisor to the committee, and her FLOW-MATIC language formed the basis for COBOL. As a result, she is sometimes referred to as the "Grandmother of COBOL."

COBOL allowed programmers to write instructions for computers using word commands, like "move" and "copy," as well as characters like plus signs and equal signs. The computer translated COBOL programs into machine language instructions and carried them out. By using English words instead of complicated numeric codes, COBOL made it much easier to write and understand computer programs. In addition, COBOL was compatible with all types of computers and thus facilitated the exchange of programs between users. The COBOL language has been continually updated and improved over the years, but it remains in wide use today.

> *Hopper taped the dead moth into her logbook with a note saying that her team had "debugged" the computer. This was one of the first times the term "bug" was used to mean a problem within a computer. "From then on, when anything went wrong with a computer, we said it had bugs in it."*

Hopper with the UNISERVO.

Promoted to Rear Admiral in the U.S. Navy

In 1971, Hopper retired from her position with the Rand Corporation in order to work full-time for the U.S. Navy. She had been promoted to the rank of commander in 1966. But a short time later she received a notice saying that she had already served longer than the 20-year limit for people in the Navy Reserves and asking her to retire. Hopper reluctantly submitted the paperwork for her retirement. A few months later, however, the

Navy changed its mind. Officials asked Hopper to return to the service on a "temporary" basis in order to help the Navy translate all of its computer programs into COBOL. A few years later, Hopper became the Director of Navy Programming Languages and set up an office in the Pentagon building in Arlington, Virginia.

During her years at the Pentagon, Hopper became known for her outgoing personality, strong opinions, and willingness to bend the rules. She always looked for new and better ways of doing things, and she had little patience for people who insisted on always doing things the same way. As a way of showing her colleagues the importance of independent thinking, Hopper kept an unusual clock on the wall of her office. The numbers were backwards, and the hands moved counterclockwise. "That's so nobody in the office can ever say 'We've always done it this way,'" she explained. "It tells perfectly good time. The first day people have trouble reading it. By the third day, they realize there is no real reason for the clock to run clockwise." Hopper also kept a black, skull-and-crossbones pirate flag on her desk in her Navy office. And she could often be seen walking through the halls of the Pentagon pulling a child's red wagon full of boxes of documents.

> *By 1952, when Hopper was ready to introduce her invention, the A-0 compiler, to the world, no one believed it was possible to program a computer to understand language and perform complicated mathematical equations from memory. "I had a running compiler, and nobody would touch it because, they carefully told me, computers could only do arithmetic; they could not do programs. It was a selling job to get people to try it. I think with any new idea, because people are allergic to change, you have to get out and sell the idea."*

Part of Hopper's job with the Navy involved speaking to various government and business groups. She talked about things like the need for standardization in programming languages and the possible future uses of computers. She was a very popular speaker and even appeared on the television news program "60 Minutes" in 1983. During Hopper's years of service, she saw dramatic changes in the size and power of computers. With the invention of silicon memory chips, computers decreased in size from the 50-foot long Mark I to desktop models. By the 1980s, in fact, programmers could fit all of the processing power of the Mark I on a single, thumbnail-sized chip.

In 1985, at the age of 78, Hopper received her final promotion in the U.S. Navy, to the rank of rear admiral. She became the first woman ever to achieve such a high rank. The following year, however, the Navy's age regulations finally caught up with her and she was asked to retire. Her retirement ceremony took place in 1986 on board the U.S.S. *Constitution,* which was the oldest commissioned ship in the Navy. Hopper requested it as the site of her ceremony because she was the oldest sailor in the Navy at that time. She received a special citation which read: "Rear Admiral Hopper's personal dedication, technical expertise, and broad-based knowledge of computers were a cornerstone of the Navy's continuing development of Information Systems technology. She is one of the Navy's most effective public speakers and a sought-after advisor on the subject of automatic data processing."

> *"Throughout her talks with young people, Hopper always emphasized the importance of thinking independently and taking intellectual risks. "A ship in port is safe. But that's not what ships are for. Be good ships. Sail out to sea, and do new things. When you have a good idea and you've tried it and you know it's going to work, go ahead and do it— because it is much easier to apologize later than it is to get permission."*

Encouraging Young People to Pursue Their Goals

After ending her Navy career, Hopper took a job as a consultant for Digital Equipment Corporation (DEC), a major computer manufacturer. "I don't think I will ever be able to really retire," she noted. "I've always liked to work with either my head or my hands. I'm not content being a spectator." She became a sort of goodwill ambassador for DEC, frequently appearing at schools and businesses. She particularly enjoyed speaking to young people and helping introduce them to the world of computers. "We talk about our natural resources, we talk about oil and coal and timber," Hopper stated. "But our young people are our future. Without them the natural resources will be of no use at all. It's to those young people we must look for the future of the country. And it is to them that we must give the best possible training."

Remington Rand

Hopper at work on the UNIVAC.

Throughout her talks with young people, Hopper always emphasized the importance of thinking independently and taking intellectual risks. "A ship in port is safe. But that's not what ships are for. Be good ships. Sail out to sea, and do new things," she told her audiences. "When you have a good idea and you've tried it and you know it's going to work, go ahead and do it — because it is much easier to apologize later than it is to get permission." But Hopper also warned students against taking risks with their health and welfare. "Never risk anything that will damage your brain," she noted. "If you are going to enjoy music, pictures, books, anything, you need your mind at its freshest, not damaged by alcohol or drugs. Besides which, the only way you're going to earn a living is using your head."

In 1991, Hopper received the National Medal of Technology from the President of the United States. She became the first woman to earn the country's highest scientific honor. As 1991 drew to a close, however, Hopper fell ill. She died in her sleep at her home in Arlington, Virginia, on January 1, 1992. She received a full Navy funeral and was buried at Arlington National Cemetery. Even after her death, the woman known as "Amazing Grace" and "The Grand Old Lady of Software" continued re-

Commodore Hopper standing with President Ronald Reagan and members of her family after her promotion ceremony at the White House, December 1983.

ceiving honors. In 1994, she was inducted into the National Women's Hall of Fame. And in 1996, the Navy announced that it was naming its newest ship — the world's most technologically advanced destroyer — the U.S.S. *Hopper.*

MARRIAGE AND FAMILY

Grace Brewster Murray married Vincent Foster Hopper on June 15, 1930. They were divorced in 1945, and he died a short time later in World War II. They did not have any children.

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Achievement Award (Society of Women Engineers): 1964
Man of the Year (Data Processing Management Association): 1969

Harry Goode Memorial Award (American Federation of Information Societies): 1971
Wilbur L. Cross Medal (Yale University): 1972
Distinguished Fellow (British Computer Society): 1973
Legion of Merit (U.S. Navy): 1973
W. Wallace McDowell Award (Institute of Electrical and Electronics Engineers): 1979
Meritorious Service Medal (U.S. Navy): 1980
Achievement Award (American Association of University Women): 1983
Engineering and Science Hall of Fame: 1984
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WORLD WIDE WEB SITE

http://www.sdsc.edu/Hopper/

UPDATE

Steven Jobs 1955-

American Computer Pioneer
Co-Founder of Apple Computer

[Editor's Note: Steven Jobs is a seminal figure in the history of the computer industry. The personal computer revolutionized our society, and Jobs was one of the people who revolutionized the personal computer. With Stephen Wozniak, who is also profiled in this volume, Jobs co-founded Apple Computer. Jobs was first profiled in Biography Today *in 1992, but a lot has happened since then. In fact, in recent years Jobs has enjoyed an unparalleled comeback, becoming once again a major figure in the industry. This Update fo-*

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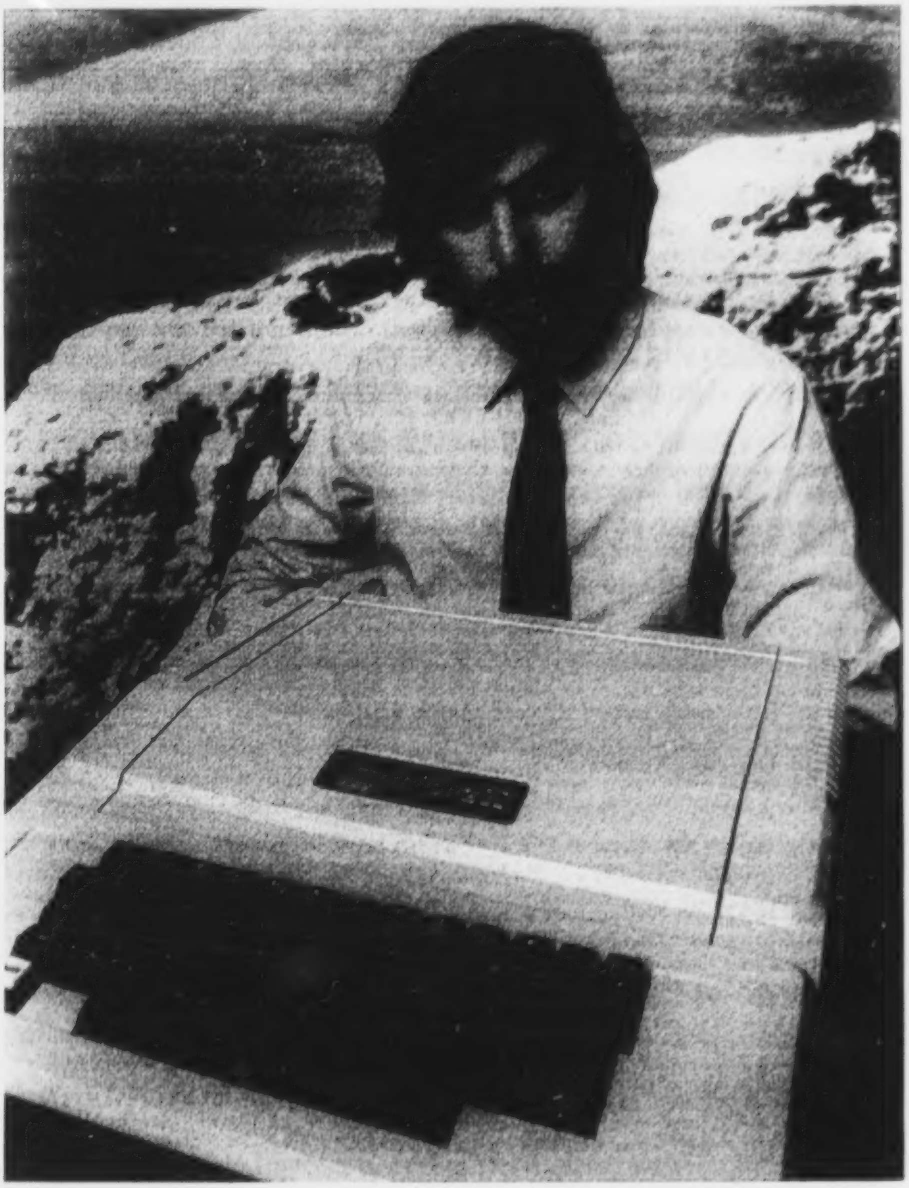
cuses on the events in Jobs's life and career since 1992, including his difficult years at NeXT, his success with Pixar, his amazing comeback at Apple, and his prospects for the future.]

SOME BACKGROUND ON JOBS'S EARLY CAREER

Jobs has had a very eventful career. He got started in the mid-1970s, when he hooked up with Steve Wozniak and began attending meetings of the Homebrew Computer Club, a group for computer professionals and hobbyists. In 1976, Jobs and Wozniak founded Apple Computer, and they were soon building computers in Jobs's parents' garage. At that point, when Apple was first starting out, computers were massive, bulky machines owned only by businesses, universities, and the government. They were very complex machines that only professionals could master. There were no personal computers. In 1976, though, Jobs and Wozniak began selling their first computer, the Apple I. With no keyboard, monitor, power supply, or software, the Apple I was really just for knowledgeable computer hobbyists. In 1977 Jobs and Wozniak created the Apple II, which set off a revolution in the industry. It was the first fully assembled desktop programmable computer. Created for beginners and general users, it was small and easier to use, featured color graphics, and included a built-in keyboard, speaker, power supply, and case.

That success was followed up in 1984 with the Macintosh. At that point computer operating systems were still completely based on text. Computer users still needed to type complicated sequences of commands or maneuver multiple keys at a time, including the control, alt, tab, and function keys. It was difficult for non-experts to master. With the Mac, Jobs and Wozniak offered a unique operating system with a graphical user interface (GUI, pronounced "gooey"). It used pictures, in addition to text, and allowed users to point a mouse and click at easily identifiable icons. While Xerox had created the first GUI, Apple was the first to develop it for the personal computer.

With the GUI, the new Mac was even simpler than the Apple II — in fact, people called it intuitively obvious — making it truly the first computer for everyday people with no electronic knowledge or experience. These early Apple computers are regarded as the first personal computers, and they convinced the world that there was a market for personal computers for regular people and their families, not just for businesses and universities. It's hard to overstate their importance. According to Nicholas Negropone, the director of the Media Laboratory at the Massachusetts Institute of Technology, "The Mac changed the course of computing with its interface,"



Jobs introducing the new Apple II, 1977.

Negropone says. "It was so easy to use and so dreadfully obvious that the first thing you did with the manual was throw it away." The company soon became known for its loyal customers, who have viewed Apple equipment as far superior to other computers. With the Apple II and the Macintosh, Apple is credited with establishing the personal computer industry.

Yet Jobs was known for more than that. At Apple, he became known for his masterful marketing, gifted showmanship, infectious enthusiasm, and charismatic charm. Colleagues would speak of the Jobs "reality distortion field," a reference to his ability when speaking to entrance, motivate, and persuade people. They might later doubt and question his statements, but while listening to him they're convinced. "You could go into a meeting with Steve," said one former employee, "and if he told you to jump off the Golden Gate Bridge, you would. There is just something about him. He is incredibly charismatic, and that word doesn't even come close." That view was echoed by computer consultant Rick Doherty. "After a trade show, people just want to go up and touch him," Doherty said. "They hang onto his every word. I've only seen this with religious leaders." And in his trademark black turtleneck, blue jeans, and sneakers, Jobs was an original in the business world. "He is an icon for a generation of entrepreneurs who want to make money, have fun, and change the world," said *Fortune* magazine. "Jobs made business fun."

> *"He is an icon for a generation of entrepreneurs who want to make money, have fun, and change the world," said* Fortune *magazine. "Jobs made business fun."*

But during the 1980s, things at Apple changed. Wosniak became dissatisfied with the company, and he left Apple. Meanwhile, Jobs had recruited John Sculley from PepsiCo to run Apple. According to the mythology of Silicon Valley, he recruited Sculley by asking, "Do you want to sell sugar water for the rest of your life, John? Or do you want to change the world?" Sculley agreed to work for Apple, and in 1985 Jobs lost a power struggle and left the company that he had helped create. "In my wildest imagination, I couldn't have come up with such a wild ending to all of this," he said. That began what would be another 10 years of struggle. Alan Deutschman, who later wrote a biography of Jobs, had this to say. "Before Jobs re-established himself among the industry's elite," Deutschman wrote in *Computer Reseller News,* "he weathered a decade of struggle and repeated failure as he burned through most of his personal net worth. But he had persistence, a rare quality when CEOs are judged not just by quarterly financial results but by daily stock performance. Jobs was often too far ahead of his time."

STARTING NeXT

But Jobs didn't give up on business or the computer world. He went on to start a new company, called NeXT Computer Inc. He invested about $10 million of his own money, and as much as $250 million from investors. At NeXT, their goal was to reach the university and college market. Jobs recruited many former Apple employees. They started out creating computers, elegant black boxes with fast microcomputers and superior graphics and sound. Consumer enthusiasts, particularly programmers, loved the NeXT system. But NeXT computers never became big sellers among mainstream users because they couldn't network or run common software. So the company eventually turned to just developing software. They specialized in software that could be easily customized by programmers, especially for creating Web sites. In particular, they created NextStep, which Jobs hoped would become the dominant operating system. But in the meantime, Microsoft had created Windows. Instead, the market was dominated by Microsoft MS-DOS and Microsoft Windows, an operating system that many say was patterned after the operating system on the Mac.

BUYING PIXAR

While working on NeXT, Jobs also got involved in another business, which would soon become Pixar. He had first heard of the company back in 1984, when he was still at Apple. At the time, he tried to convince Apple's board of directors to buy it, to no avail. Pixar was then a division of LucasFilm Ltd, owned by George Lucas. He had created it to work on special effects for his films and to design computerized equipment for editing and printing film. Also in 1984, the company recruited John Lasseter, an animator and director who has received much of the credit for the success of the company's later projects (for more information on Lasseter, see *Biography Today*, September 2000).

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In 1986, Jobs bought the division from Lucas for $10 million, and it was renamed Pixar. They started out making workstations and software that could be used to enhance digital images, like those in x-ray images taken in hospitals or in satellite photographs taken by intelligence agencies. Eventually, they switched to just making software. One successful software product was RenderMan, which allows computer graphic artists to put textures and colors on 3-dimensional objects. RenderMan was the software used to create the realistic skin and teeth on the terrifying di-

Jobs with a NeXT computer, 1988.

nosaurs in the film *Jurassic Park*. But none of these products was financially lucrative, and Jobs ended up investing about $50 million of his own money to keep the company going. "If I knew in 1986 how much it was going to cost to keep Pixar going, I doubt if I would have bought the company," Jobs admits. "The problem was, for many years the cost of the computers required to make animation we could sell was tremendously high. Only in the past few years has the price come down to the point that it makes business sense."

In addition to its technical division, Pixar had a division that made short animated films, mostly to show off applications of the company's software. Those films, made by John Lasseter and his colleagues, started winning awards and earned the company a reputation for quality in the field. In the early 1990s, they teamed up with Disney to work on a full-length animated feature film. Their process was revolutionary in several ways. Previous animated films had used hand-drawn and painted pictures, which gives a flat or 2-dimensional effect. But Pixar developed a means of creating 3-dimensional mathematical models, stored in the computer, for all of its characters, props, and sets. The animators at Pixar were able to manipulate these objects as if they were real. Because the images were stored in the computer, they could be more easily reproduced and reused in film sequels, videos, CD-ROM games, or other spinoff products. And the technology created 3-D images that were unprecedented in how realistic they looked.

Despite the company's great technological advances, Pixar's most valuable quality, according to many, was its ability to tell a moving story. Their first film, *Toy Story,* was released in 1995. It immediately became a critical triumph and a box-office smash. Soon after, Jobs took the company public and sold stock to interested buyers. Pixar followed up that first film with two subsequent successes, *A Bug's Life* in 1998 and *Toy Story 2* in 1999, further driving up the value of the company. Jobs's share of the company has grown in value to over $1 billion.

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THE RETURN TO APPLE

In the meantime, during the decade or so after Jobs left Apple, the company had struggled financially. Both sales and market share had dwindled, as more and more computer users eschewed the Macintosh for the IBM-compatible PC, using the Windows operating system created by Microsoft.

But Jobs and Apple were soon to be reunited. In December 1996, Jobs sold NeXT to Apple to become the operating system of its next generation of computers. He earned over $400 million for the sale and returned to Apple as a consultant. While he was serving in that role, the Apple board forced out then-CEO Gilbert Amelio; the board announced that Jobs would "assume an expanded role as a key advisor to Apple's board and executive management team." Soon after, employees began to report an end to the apathy and dissatisfaction then prevalent at the company. "There is an incredibly high level of energy on the Apple campus compared to four weeks ago," one computer consultant reported. "Everybody is really charged up; and it's all because of Steve Jobs's new role." The company's loyal customers were excited, too, hoping that these changes boded well for the future.

THE COMEBACK

In September 1997 Jobs was named interim CEO of Apple. In that role, he would have his work cut out for him. Apple was going through a very difficult period. Sales were down, and market share was continuing to slip. Microsoft was clearly the dominant operating system with about 85% of the market; only about 10% of computers were made by Apple using the Macintosh operating system. As interim CEO, Jobs undertook several measures. He eliminated the company's licensing program, meaning that no other company would be allowed to make computers based on the Mac system. He consolidated the company's product lines to focus specifically on the areas of education, home, and desktop publishing. He also streamlined the company's production process by outsourcing manufacturing, cutting back on the number of distributors, and significantly reducing the amount of inventory kept on-hand.

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> *"Steve is chief cook and bottle washer right now. He will be there until they kick him out or when he doesn't see a need to be there. He's basically come in and saved the company. I don't think anyone short of Steve Jobs could have turned Apple around. . . . You need somebody that creative, and that much of a maverick. . . . Apple needs all that."—Andy Gore, editor in chief of* MacWorld
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In a bold move that was both cheered and jeered, Jobs teamed up with Microsoft, even though many Apple fans consider them the enemy. Microsoft agreed to settle a long-standing lawsuit in which Apple had charged patent infringement, claiming that Microsoft had stolen ideas from the Macintosh operating system to use in Windows. Microsoft agreed to invest $150 million in Apple and to make sure that popular Microsoft software would be made for the Macintosh platform, a move that was sure to please Apple customers because it would give them more choices in software.

Jobs unveiling the new iMac computer, 1988.

Many people believed that only Jobs could help restore Apple to health. "Steve is chief cook and bottle washer right now," said Andy Gore, editor in chief of *MacWorld*. "He will be there until they kick him out or when he doesn't see a need to be there. He's basically come in and saved the company. I don't think anyone short of Steve Jobs could have turned Apple around. . . . You need somebody that creative, and that much of a maverick. . . . Apple needs all that."

THE iMAC

A huge factor in the company's resurgence was their new computer, the iMac. When it was introduced in August 1998, the iMac was an immediate sensation. With its vibrant colors and rounded shape, it represented the first truly distinctive basic design. The product launch was supported with a massive, bold advertising campaign that featured photographs of modern iconoclasts who have shaped history or culture, emblazoned with the slogan "Think Different." Jobs was instrumental in creating this widely praised advertising campaign, which showcased once again his skill as a marketer and pitchman. "Steve's incredible resurgence with the turnaround of Apple . . . really captured the themes of Silicon Valley of the '90s. Here's someone who's passionate about technology, but whose success was largely based not on engineering prowess but on marketing and image-making and public relations."

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> *"[Apple's] predicament is that in the desktop computer market there is bound to be only one winner— markets based on standards tend to work that way—and the IBM-compatible PC is it. . . . [No] amount of restructuring, marketing, or price-cutting can disguise the fact that Apple is the Betamax of computers."*—The Economist
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Throughout late 1998 and 1999, after the introduction of the iMac, the company posted solid gains in earnings. The changes in leadership and direction seemed to satisfy Apple's customers as well as analysts on Wall Street, and the price of Apple stock continued to rise. The stock price hit an all-time high of $118 in December 1999. Soon after that, Jobs dropped the word "interim" from his title and became the CEO of Apple in January 2000. But company profits took a tumble during 2000, and by the end of that year Apple reached a low of just over $13 a share. While the new Apple iBook SE earned praise, sales of the new Power Mac G4 Cube were slower than expected, as many felt that it didn't offer much that was new, considering its high price.

WHAT'S NEXT FOR APPLE AND JOBS

Apple plans to introduce several new products in 2001, including a new ultra-thin notebook computer, new software for editing music and video, and a new operating system. The company hopes that the new operating system, known as the Mac OS X (ten), will be the foundation for a decade of new software and the start of the company's recovery from recent losses.

At this point, it's unclear where the company will go from here. Apple was very strong shortly after Jobs returned, but it floundered again soon afterward. Industry analysts have questioned whether Jobs will ever be able to return the company to long-term stability and profitability. With their elegant design and ease of use, Mac computers inspire undying loyalty in many consumers. But there's no getting around the fact that few users today choose Mac computers, and that the IBM-compatible personal computer with Microsoft Windows has become the industry standard. Here, a columnist from *The Economist* discusses how Apple's computers might eventually become obsolete, like the Betamax videotape system, which was overrun by the now current and dominant VHS system. "The firm's predicament is that in the desktop computer market there is bound to be only one winner—markets based on standards tend to work that way—and the IBM-compatible PC is it. . . . [No] amount of restructuring, marketing, or price-cutting can disguise the fact that Apple is the Betamax of computers."

Despite such dire predictions, few people would be willing to discount Steven Jobs, especially since he made such an amazing comeback. He was ousted from the company that he founded, only to build up a new computer animation company to critical and popular acclaim and record profits. Then, he was asked to come back and run the company that had earlier ousted him. And clearly, he continues to enjoy the work that he does. "I get to come to work every day and work with the most talented people on the planet," Jobs said. "It's the best job in the world."

HOME AND FAMILY

Jobs lives in Palo Alto, California, with his wife, Laurene, and their two children, son Reed and daughter Laurene. His older daughter from a previous relationship, Lisa, is now in college. Jobs and his family are strict vegans, which means that they eat no animal products at all. They have a large garden, where they grow a lot of their own vegetables and herbs.

Jobs's family life has been in the news several times in the recent past. One aspect has been his relationship with his eldest daughter, Lisa, which made news because he contested paternity. Jobs wasn't very involved in Lisa's early life—when she was young, he had just launched Apple and he worked all the time. But they eventually grew closer, and she lived with him during her teen years. In other news, Jobs, who was adopted, tried for years to find his biological parents. He eventually discovered that his father was a political science professor and his mother was a speech therapist. They were unmarried at the time that Jobs was born, but they later married and had another child, Mona Simpson, who is his sister. The two have since become close.

Simpson is an accomplished and respected novelist, the author of *Anywhere But Here, The Lost Father*, and *A Regular Guy*. In the latter novel, she wrote about a biotechnology engineer who is arrogant, egotistical, and emotionally distant. He is unmarried but has a daughter. Yet he pays little attention to her until he settles down, gets married, and embraces family life. Many saw obvious parallels between Simpson's book and Jobs's life. He has agreed that he is the model for the character, but he declines to discuss which elements of the book are fact and which are fiction.

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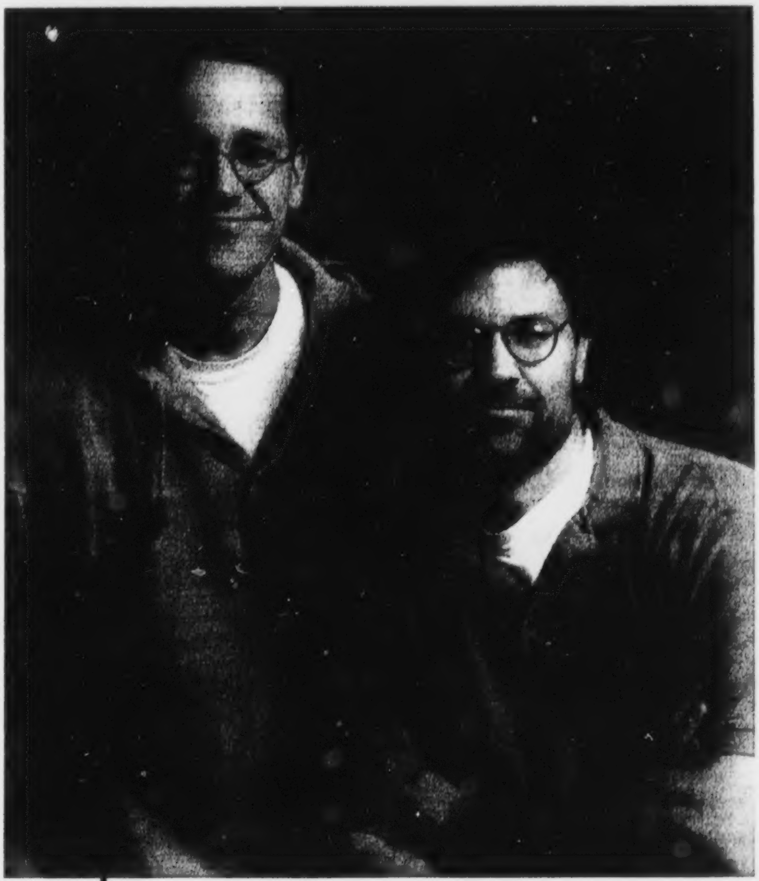
ADDRESS

Apple Computer
1 Infinite Loop
Cupertino, CA 95014

WORLD WIDE WEB SITE

http://www.apple.com



Rand Miller 1959-
Robyn Miller 1966-

American Computer Software Designers
Creators of *Myst* and *Riven* Computer Games

BIRTH

Rand Miller (born in 1959) and Robyn Miller (born in 1966) are two of the four sons of Ronald Miller, a minister, and Barbara Miller, a homemaker. Rand is the eldest of the Miller boys, while Robyn was born third. Rand and Robyn's other brothers are Rod, the second oldest, and Ryan, the youngest.

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YOUTH

Ronald and Barbara Miller raised their four sons in a close-knit family environment that encouraged creativity and intellectual exploration. In fact, they made special efforts to help their children develop their imaginations. For example, Ron often used cardboard refrigerator boxes to build elaborate cardboard forts, spaceships, and caves for his sons, who crawled around in them for hours. They were also very supportive of their children's youthful interests. "My mother was incredibly, almost overly encouraging," recalled Rand. "She would come up with the least little picture we had drawn and [say] it was the most wonderful thing ever."

> *"[Rand and Robyn] grew up reading things like* The Lion, The Witch, and the Wardrobe, *which we read as a family, and a lot of C.S. Lewis stuff, and the Tolkien stories [like]* The Lord of the Rings,*" recalled their father, Ron Miller. "They loved that kind of thing and [as a result,] their imaginations, I think, were stretched."*

The Miller family also placed heavy importance on reading as a tool for both learning and enjoyment. "They grew up reading things like *The Lion, The Witch, and the Wardrobe,* which we read as a family, and a lot of C.S. Lewis stuff, and the Tolkien stories [like] *The Lord of the Rings,*" recalled Ron Miller. "They loved that kind of thing and [as a result,] their imaginations, I think, were stretched."

As the Miller boys grew older, the family dinner table became a place where they could talk freely about their impressions of the world around them. The Miller brothers engaged in spirited debates with each other and their parents about religion, politics, art, and all sorts of other subjects. Robyn recalled that his parents were not afraid to admit when their sons might be right about some issue: "They would kind of change their mind and say, 'Yeah, you're right,' or 'I don't know. We'll have to see if we can find that out.'"

Rand was first drawn to computers as a teenager. During his junior high and high school years in Albuquerque, New Mexico, he spent much of his free time in front of a computer screen at the nearby University of New Mexico computer science building. He spent part of this time playing, but he also devoted a lot of effort to developing various computer programs. Back home, meanwhile, he built an entire computer out of used parts.

As Rand's knowledge of computer software grew, he devised several interesting computer games. "When Rand was in the 11th grade, he developed a game called Swarms, about killer bees that try to invade the U.S.," recalled his mother. "It was so phenomenal that his computer teacher tried to convince him to enter a national computer contest. He didn't think he had a chance. I bugged him until he entered, and he won second place."

Robyn did not share his oldest brother's passion for computers. Instead, he preferred to spend his time painting, drawing, and playing guitar. In fact, Robyn later stated that "when I was young, [music] was my core interest." These sorts of hobbies were a good fit for his quiet nature. He spent hours at a time in his room or at the kitchen table, playing music or drawing imaginary creatures and landscapes of fantasy worlds. During this time, Ronald and Barbara Miller repeatedly expressed admiration for his creative streak. His mother, he recalled fondly, "loved all my hideous drawings."

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EDUCATION

As the Miller boys grew up, their father served as a minister for independent churches all around the United States. This meant that the family often relocated to a new town, where each boy had to become acquainted with a new school. This situation presented a challenge for Rand, Robyn, and their brothers, because they had to make new friends at every school they attended. But the warm and accepting environment at home helped them adjust to their constantly changing surroundings.

Both Rand and Robyn earned good grades in high school. Rand briefly attended college in the late 1970s, but he soon left school and accepted a computer programming position at a bank in Henderson, Texas. Robyn, meanwhile, enrolled at the University of Washington in 1985. He decided to pursue a degree in anthropology, the scientific study of the origins and development of mankind.

CAREER HIGHLIGHTS

Creators of Children's Software

In 1987 Rand came up with an idea for a CD-ROM computer game for children. He called Robyn at the University of Washington and asked him if he would lend his drawing talents to the effort. Robyn eagerly accepted the offer, and within a matter of months they had completed their first CD-ROM computer game. The game, which they called *Manhole,* took young players on an adventure into a fanciful underground world. "[It] was basically a world which children would explore, with odd creatures and whimsical sounds," recalled Rand. The game proved popular with youngsters and teachers alike. It also caught the attention of the software industry. In fact, the Software Publishers Association gave *Manhole* a special award in 1988, stating that it represented the year's "best new use of a computer."

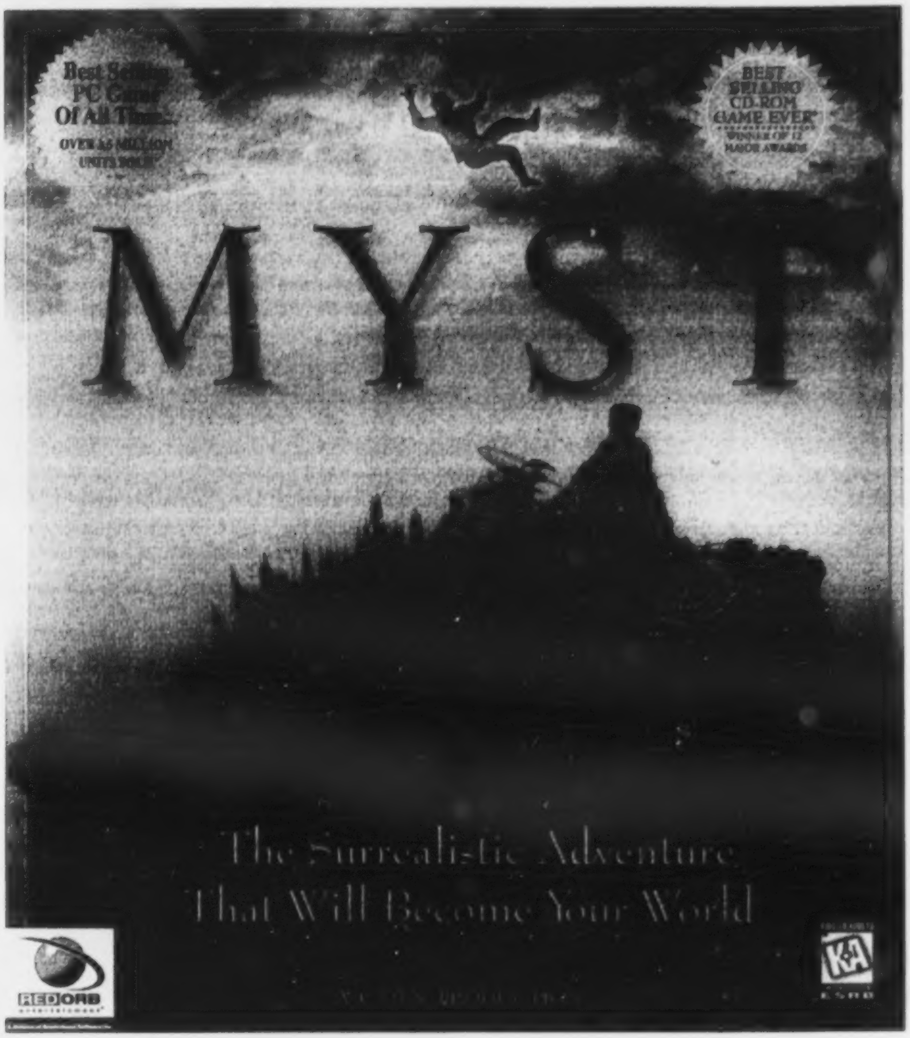
> "*Myst is more than a game — it's an experience," stated Rand. "Robyn and I set out to create a virtual mystery that combined gorgeous graphics and great sound, the trademarks of CD-ROM, with truly challenging puzzles and an engaging storyline to tie it all together."*

The success of *Manhole* convinced the brothers to establish a software business together. In 1989 Robyn left college and joined his brother in Spokane, Washington, where their father was working as a minister for an independent Bible church. Rand and Robyn established their business in the garage of Chris Brandkamp, who was a member of their father's church. They called the company Cyan Inc

Over the next few years, Rand and Robyn created a number of popular children's software programs. In 1990 they released *Cosmic Osmo,* a game that took children to heaven on a strange spaceship. Two years later they completed *Spelunx.* This CD-ROM game helped kids learn about science and nature through experiments.

Creation of *Myst*

Rand and Robyn enjoyed working on children's software. They got a great deal of satisfaction from creating games that were both educational and fun to play. But in the early 1990s they decided to turn to a new challenge: creating a computer game that would interest teens and adults. Over a pe-


Best Selling PC Game Of All Time...
BEST SELLING CD-ROM GAME EVER
WINNER OF 12 MAJOR AWARDS
MYST
The Surrealistic Adventure That Will Become Your World
RED ORB
K-A

riod of several months, the two brothers worked together to create a fantasy world that was mysterious and enchanting but nonviolent. They wanted it to be the sort of game they would feel comfortable playing with their children. "We were making it for us, so that we could play something," admitted Robyn.

As work on the game progressed, both Rand and Robyn came to see their partnership as a kind of marriage. "It's a similar relationship to that," said Rand. "No matter what your partnership is, there is the potential to . . . speak your mind. That's the positive and the negative. If someone comes

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up with a dumb idea and you can't speak your mind, the dumb idea goes through. If I don't like something, I can say it, and we don't get into large arguments; frankly, we work well together because his goal is about creating and perfecting this stuff, and my goal is the technical completion of it. We fill each other's blanks nicely."

The Miller brothers finally completed work on the game, which they called *Myst,* in 1993. *Myst* takes players to a small island — Myst Island — that has been mysteriously abandoned. As the game progresses, players explore the various buildings on the island, including a planetarium, a library, a cabin, a clock tower, and a spaceship, to discover the secret behind the island's emptiness. As players solve puzzles and gather clues, they learn that the island was once the home of a brilliant inventor named Atrus. This man learned how to write books that could transport people to fantastic worlds of his own creation. But one of his sons — either Achenar or Sirrus — is responsible for wrecking the worlds he created. As the game progresses, players travel to these worlds to unravel the mystery of the island and Atrus's family.

Both Rand and Robyn were surprised by the runaway popularity of Myst. *"We were just shocked," recalled Rand. "It's an understatement to say we were surprised." Robyn was also stunned by the fuss over the game. "It's almost silly how much attention* Myst *has received," he noted. "We knew it was good, but we were the creators. To see everyone else agreeing with us was astonishing."*

When *Myst* was released in late 1993 by Broderbund Software, it caused an immediate sensation among both adult and teen computer game players. Within a week of its release, the Internet was buzzing about this unique new game. Five months later, an estimated 200,000 copies of the game had been sold in stores around the country. During this time, the Miller brothers expressed great pride in their creation. "*Myst* is more than a game — it's an experience," stated Rand. "Robyn and I set out to create a virtual mystery that combined gorgeous graphics and great sound, the trademarks of CD-ROM, with truly challenging puzzles and an engaging storyline to tie it all together." Nonetheless, they were as surprised as anyone by the game's runaway popularity. "We were just shocked," recalled Rand. "It's an understatement to say we were surprised." Robyn was also stunned by the fuss over the

Myst *game scene*

game. "It's almost silly how much attention *Myst* has received," he noted. "We knew it was good, but we were the creators. To see everyone else agreeing with us was astonishing."

But computer game players claimed that all the excitement about *Myst* was deserved. "*Myst* is the first home-computer game I've experienced that produces the almost haunting sense of having passed into some parallel place," wrote Erik Davis in the *Village Voice*. "The reason for all the success was stunning in its simplicity," added Jon Carroll in *Wired*. "*Myst* was good. *Myst* was better than anything anyone had ever seen. *Myst* was beautiful, complicated, emotional, dark, intelligent, absorbing. It was the only thing like itself; it had invented its own category."

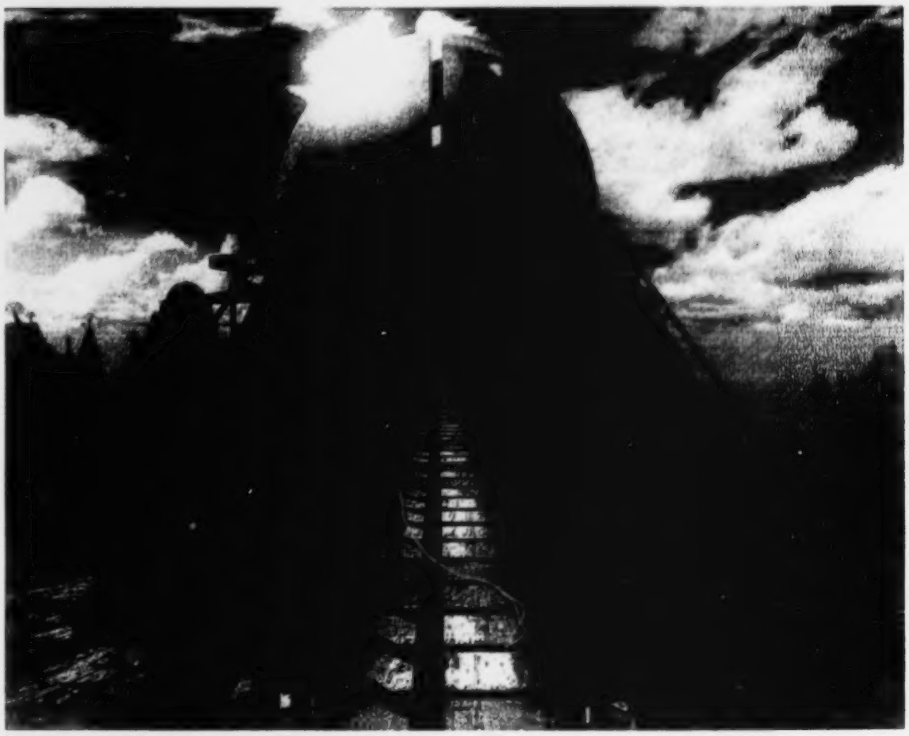
As sales of the *Myst* game surged, Rand and Robyn became wealthy for the first time in their lives. Before long, sales of *Myst* sweatshirts, mugs, mouse pads, and other items added to their fortunes. But neither brother let their new riches change their personalities or lifestyles. Instead, they continued to rely on their families and their strong Christian beliefs as the primary guiding forces in their lives. "I look at Rand and think, 'He's the same old Rand,'" said his wife, Debbie. "Success hasn't changed him or Robyn."

Myst Books

In 1994 Rand and Robyn Miller reached agreement with the Hyperion publishing company to produce a series of novels based on their CD-ROM game. These novels, which appeared from 1995 to 1998, were based on a *Myst* history that the brothers had created a few years earlier. "While we were working on *Myst*, we decided that it would be a good idea to create a background history," explained Robyn. "A sort of story that would keep our work consistent and tight. It wasn't long before we realized this story was one that people really wanted to read! We immediately set about shaping it into a novel. The novel definitely answers many hanging questions about the game: what is *Myst?* How do the books in the game work? Where did Atrus come from? More than that, though, we think the novel will be a fascinating read, even for those who have never heard of *Myst*."

> *"While we were working on* Myst, *we decided that it would be a good idea to create a background history," explained Robyn. "A sort of story that would keep our work consistent and tight. It wasn't long before we realized this story was one that people really wanted to read! We immediately set about shaping it into a novel. The novel definitely answers many hanging questions about the game: what is* Myst? *How do the books in the game work? Where did Atrus come from? More than that, though, we think the novel will be a fascinating read, even for those who have never heard of* Myst."

The first title in the *Myst* book series was *Myst: The Book of Atrus,* published in 1995. This novel explores Atrus's life before he journeyed to the magical land of Myst. One year later, the Miller brothers released *Myst: The Book of Ti'Ana*. This book centers on a titanic struggle between Ti'Ana, Atrus's grandmother, and the evil Veovis. In 1997, *Myst: The Book of D'Ni* was released. In this novel, Atrus and his wife Catherine return to a city called D'Ni, which has been destroyed by Veovis. As the couple work to rebuild the ruined city, they embark on a search for D'Ni's survivors, who have been trapped in alternate worlds.



Riven *game scene*

Riven

In the meantime, Rand and Robyn also devoted a great deal of time and energy to making a sequel to *Myst*. This five-CD game, called *Riven*, was unveiled in 1997. It was similar to *Myst* in many ways. For example, Robyn created the same sort of atmospheric music that he had used for *Myst* on the new game. In addition, *Riven* featured the same great artwork and graphics that had dazzled *Myst* players. Most importantly, *Riven* offered the same blend of mystery and fantasy that had been featured in *Myst*. "As in *Myst, Riven* places you, as the visitor, in a strange, mainly depopulated world and asks you to solve riddles in an attempt to uncover the truth, whatever that may be, about the odd family tragedy which appears to have preceded your arrival," said David Hewson in the London *Sunday Times*.

A few months after the release of *Riven*, Rand Miller published *Myst/Riven: The Art of the Game* (1997). This heavily illustrated coffee-table book showed readers how the worlds of *Myst* and *Riven* were created. This colorful, detailed volume quickly became a collector's item among fans of the two games.

Brothers End Their Partnership

Rand and Robyn Miller's partnership had enabled them to create one of the most famous computer games of the 1990s. But during the production of the *Myst* sequel *Riven*, Robyn began to feel frustrated by the storytelling limitations of computer games. In March 1998, he announced that he was leaving Cyan Inc. to form a film company called Land of Point. He explained that he wanted to explore the world of filmmaking because he felt it had greater potential for storytelling than interactive software programs. "I wanted the power just to tell a story," he said.

> *Robyn's departure from Cyan was on very friendly terms. In fact, Rand respected his brother's decision to pursue filmmaking as a new career. "We're not mad at each other," assured Robyn. "In fact, we have plans to collaborate [on projects] in the future. It's possible that Rand could create interactive worlds that are based on Land of Point movies. I would rather have no other person work on an interactive project with me than Rand."*

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Since leaving Cyan, Robyn has devoted most of his time to a massive film project known by the code-name Project Green Tea. The plot of this movie, which will make extensive use of computer-generated landscapes and creatures, centers on a rivalry between two powerful characters who live in a fantasy world. According to *Wired* magazine, "there will be five primary characters in the film, and four major settings or environments, including a bustling capital city built on an island called Japh. The great conflict occurs at a time when Japh and its surrounding empire are in a heady period of expansion . . . and the entire culture is undergoing a renaissance."

Many *Myst* fans are eager to see Robyn's fantasy film. But he is taking his time on the project, because he wants to create a work of art that he can be proud of. "Whether you're making cabinets, designing software, or writing a [magazine] article, I believe that God would have us make things well, and act creatively in every [situation], because that's what He does and we're made in His image," he explained.

As Robyn works on his film project, Rand continues to lead Cyan Inc. He is currently engaged in creating a massive new Internet game, code-named Mudpie. Rand is shaping the game so that multiple players from computer locations all across the world will be able to take part in fantasy adventures together. "The best way to describe it, it will be like being in a movie," promised one Cyan game designer.

Myst, meanwhile, continues to stand as one of the most popular interactive games in history. More than six million copies of the game have been sold since its 1993 release. In addition, two million copies of the sequel *Riven* have flown off the shelf since it was made available. And in the spring of 2000, the Mattel toy company announced that it had acquired the rights to produce two additional sequels to the *Myst* game. "We have been fans of Cyan's work from the very beginning; they've built a wonderfully rich and complex world for gamers to enjoy," said one Mattel executive. "We are taking great care in creating a game that is worthy of the *Myst* name." The first of these games will be *Myst III: Exile.* This game will be set 10 years after *Riven.* It will center around a clash between Atrus and Catherine and a mysterious figure who threatens them. Players will explore a series of new worlds to uncover the true identity of this new villain.

MARRIAGE AND FAMILY

Rand and his wife Debbie have three daughters, Kinslee, Kerryn, and Kara. Robyn and his wife Beth have one son, Alex. Both families continue to live in the metropolitan Spokane area.

HOBBIES AND OTHER INTERESTS

Rand's lifelong interest in computer games and software programming remains strong. Robyn, meanwhile, continues to enjoy music and art.

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Miller, Rand, and Robyn Miller. *Myst: The Book of Ti'Ana,* 1996 (with David Wingrove)

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ADDRESS

Cyan Corporation
14617 Newport Highway
Mead, WA 99021

WORLD WIDE WEB SITES

http:///www.cyan.com
http://www.realmyst.com

Shigeru Miyamoto 1952-

Japanese Video Game Designer
Creator of Nintendo's *Donkey Kong, Super Mario Brothers,* and *Legend of Zelda* Video Games

BIRTH

Shigeru Miyamoto was born on November 16, 1952, in Sonobe, Japan. His father, Hideo, was an English teacher. His mother, Yasuko, was a homemaker. Miyamoto was one of three children.

YOUTH

Miyamoto grew up near Kyoto, Japan, in a small country home that had been owned by his father's family for many

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years. Miyamoto was an energetic youngster who liked to play baseball and go fishing with his friends. But he did not mind spending time by himself, either. At these times, he loved to explore the wooded hillsides that surrounded his family's home. On one of these solitary trips, he discovered a dark cave hidden in the forest. He returned to the cave again and again, moving a little deeper into the darkness each time. Finally, he went deep into the cave with a homemade lantern. He did not find anything unusual in the cave, but he never forgot how his journey into its depths left him feeling excited and alive. Years later, he tried to recreate this childhood spirit of adventure in his video games.

During Miyamoto's early childhood, his family did not own a television or a car. But every few months, the entire family would take a train into Kyoto, where they would shop and see a movie before returning home. Miyamoto regarded these train trips as special treats, for they exposed him to all sorts of unfamiliar sights and sounds. Back home, meanwhile, he occupied himself by reading, drawing, painting, and constructing puppets when he was not playing outside. As time passed, he used his creativity and imagination to stage puppet shows for his parents and their friends.

Miyamoto's family moved to Kyoto when he was 11 years old. A short time later, his father finally bought the family a television. Miyamoto quickly became a big fan of several animated television series that featured Japanese superheroes. His interest in these shows spurred him to devote even more time to drawing and painting. At one point, he even organized a club at school for kids who liked to draw cartoons. The club became so popular that it held a series of annual exhibitions of the members' best work.

EDUCATION

Miyamoto attended public school in Sonobe and Kyoto. During this time, he became known to his instructors and classmates as a bright boy who sometimes spent more time drawing and daydreaming than doing his homework. After completing his secondary education in 1970, Miyamoto enrolled in the Kanazawa Munici College of Industrial Arts and Crafts.

Miyamoto enjoyed college, but his casual attitude toward his studies slowed his progress. Not surprisingly, one major distraction was his love of drawing, which he continued to indulge for hours at a time. But he also devoted a lot of his attention to American bluegrass music. He learned to play both guitar and banjo while in Kanazawa. During the early 1970s he and a friend spent many evenings strumming bluegrass music in local coffeehouses and bars. Miyamoto's music and drawing activities combined to keep him at Kanazawa for five years, instead of the four years that most students needed to earn a degree. But he finally earned his arts degree in 1975.

CAREER HIGHLIGHTS

Joining Nintendo

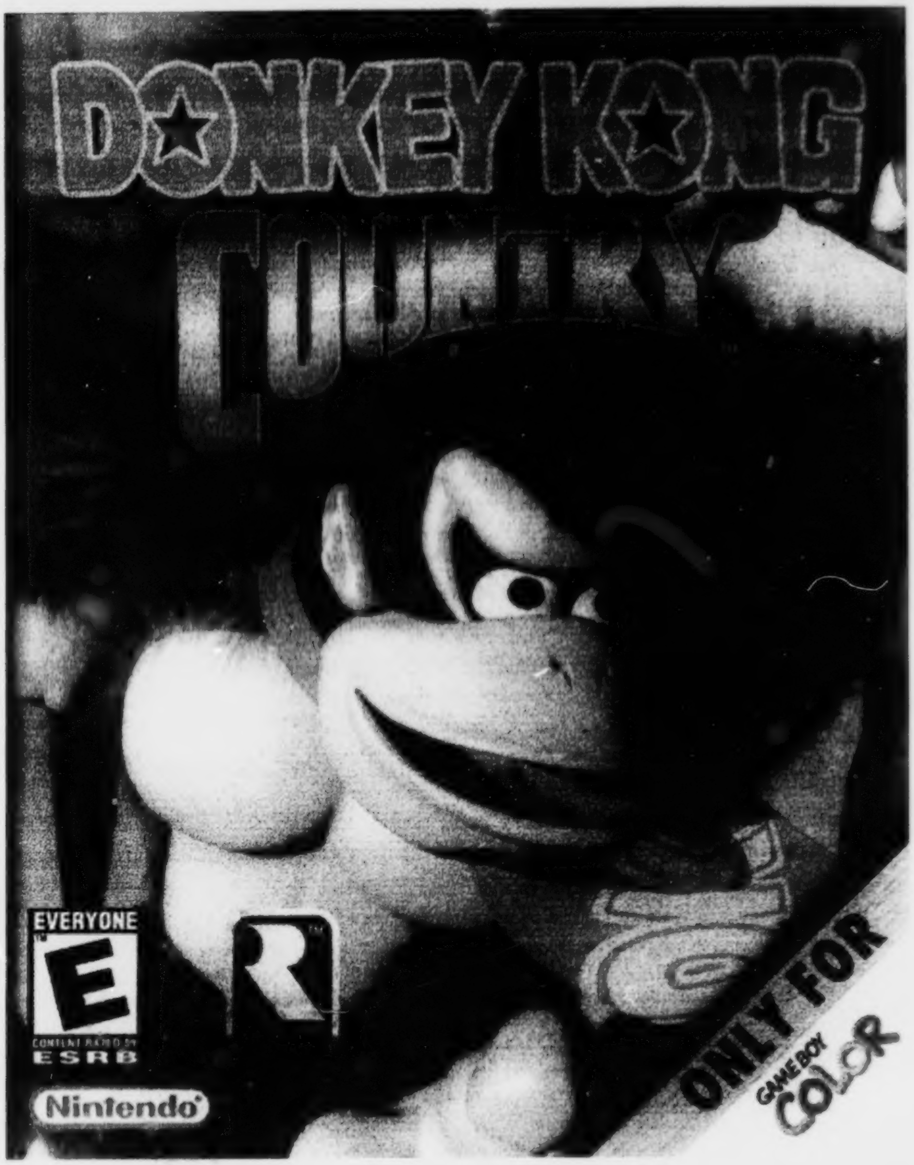
When Miyamoto graduated from college in 1975, he felt lost and uncertain about his future. He knew that he did not want to work in a traditional business setting. Instead, he wanted to find a company that would give him the opportunity to use his creativity and artistic talents. But as the weeks passed by, he was unable to secure such a job.

Finally, Miyamoto turned to his father for help. He asked him to contact an old friend named Hiroshi Yamauchi, who was president of the Nintendo toy company in Kyoto. "While a lot of my friends were trying to make big stuff like cars and consumer electronics, I rather wanted to work on concept work," he recalled. "I thought toys and other small stuff would be interesting." Yamauchi agreed to meet his old friend's son, even though he felt that Nintendo had no need for an artist. A few days later, Miyamoto walked into Yamauchi's office and tried to convince him that Nintendo could use someone with his talents.

> *"While a lot of my friends were trying to make big stuff like cars and consumer electronics, I rather wanted to work on concept work. I thought toys and other small stuff would be interesting."*

Miyamoto made a good impression on Yamauchi, who agreed to a second meeting. When the time came for this second meeting, Miyamoto arrived with several drawings of new toys that he had invented. He also brought a sack that contained samples of several other new toy ideas. For example, he showed the Nintendo chief a clothes hanger specifically designed for children. It was small and simple so that children could use it, but its hook was shaped like the head of an elephant. Yamauchi was so impressed with Miyamoto's hangers and his other new toy ideas that he hired him as Nintendo's first-ever company artist in early 1977.

When Miyamoto first joined Nintendo, it was a much different company than it is today. It had been founded in 1889 by Fisajiro Yamauchi to make Japanese playing cards, and in the early 1960s it became a major maker of children's games and toys. But Nintendo was not heavily involved in video games in the late 1970s. After all, video games were relatively new during that time, and Nintendo and other toy manufacturers doubted whether they would ever be widely popular.


DONKEY KONG
COUNTRY
EVERYONE
E
CONTENT RATED BY
ESRB
Nintendo
ONLY FOR
GAME BOY
COLOR

Creating *Donkey Kong*

During his first months of employment at Nintendo, Miyamoto designed artwork for playing cards sold in the United States and Europe. But one day, Yamauchi called him into his office and gave him a new assignment. He told Miyamoto to create a concept for a new video game that could be sold to video arcades.

Miyamoto was delighted with the challenging assignment. "In those days I sometimes joked that I was one of the five greatest game designers in the world," he recalled. "Simply because there were no other game designers in the world." But he knew that he would need the support of the company's technical staff if he hoped to succeed. "I had no knowledge about computers at all," he remembered. "There were some ingenious technicians who were kind enough to teach me so many things, knowing that I was an amateur in those areas."

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> *In creating* Donkey Kong, *Miyamoto says, "I wanted to make it . . . difficult to climb upward, so I chose the settings of a building under construction and a ship's gangway where obstacles were constantly falling down and getting in the way. I like the image of a barrel rolling down a gangway—it's fun to look at, you know? As for the character, . . . I got the idea from King Kong and Popeye. Like King Kong, Donkey Kong is a climbing gorilla who finds a lady. But Donkey Kong is also silly, in the same way that Bluto is silly as he tries to steal Olive Oyl from Popeye."*
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Over the next several weeks, Miyamoto considered several different video game concepts. He finally decided to develop an animated game that came to be known as *Donkey Kong*. In Miyamoto's new game idea, a captive gorilla escapes from his cage, steals his master's girlfriend, and climbs to the top of a building. The players in Miyamoto's game then take the role of the master and try to rescue the girl from the clutches of the big ape.

As Miyamoto developed the game, he decided to turn the setting into a crazy obstacle course for the game player. "I wanted to make it . . . difficult to climb upward [to reach the gorilla], so I chose the settings of a building under construction and a ship's gangway where obstacles were constantly falling down and getting in the way," Miyamoto said. "I like the image of a barrel rolling down a gangway—it's fun to look at, you know? As for the character [of Donkey Kong], . . . I got the idea from King Kong and Popeye. Like King Kong, Donkey Kong is a climbing gorilla who finds a lady. But Donkey Kong is also silly, in the same way that Bluto is silly as he tries to steal Olive Oyl from Popeye." The character of the master, meanwhile, came to be known by the name Mario. He was drawn as a roly-poly man with a big nose and a mustache, dressed in bright suspenders and an oversized cap.

> *In* Super Mario Brothers, *Mario and Luigi chase unusual animals around a network of underground pipes deep beneath New York City. "I liked the idea of a game where creatures would move from top to bottom on screen and then back up again. When I thought about what kind of creatures those should be, turtles and crabs just seemed like a good fit. Since there are lots of pipes underground, I decided to use those for the creatures to move along. While I had never been to New York, I liked what I had seen of the city in movies and imagined that it must have a huge underground world that would be a perfect setting for the game."*

As Miyamoto put the finishing touches on *Donkey Kong,* many people expressed doubts about the game. Some observers believed that his creation was doomed because video arcades seemed to be fading in popularity. Nintendo salespeople, meanwhile, claimed that American kids would think that the game was stupid. Some of them even asked Nintendo to reconsider releasing the game. But Yamauchi wanted to see for himself whether Miyamoto's game caught the attention of the world's video players.

Within weeks of its release in 1981, it became clear that *Donkey Kong* was a big hit. It emerged as one of the most popular attractions in video arcades all around the world, including Japan and the United States. By the end of 1981, it was ranked as the year's second best-selling arcade game worldwide. Industry analysts saw many different reasons for *Donkey Kong's* astonishing popularity. They noted that Miyamoto's creation was the first video game that featured an actual storyline behind the gameplay. They also pointed out that *Donkey Kong* introduced the concept of game playing levels. Under this system, once a player conquered one level of play, he/she then moved on to new levels of difficulty that presented new challenges. This format is now standard in thousands of video games. Finally, video players and programmers pointed out that the characters in *Donkey Kong* were very appealing. "Both Mario and Donkey Kong . . . had personality," wrote Elliott Chin in *Computer Gaming World.* "Mario in the way he ran and jumped, and Donkey Kong in his chest-pounding tantrums. It all seems unspectacular now, but in 1981, it was amazing."

Creating Popular Mario Sequels

The popularity of *Donkey Kong* paved the way for Miyamoto to create new video games for Nintendo. He helped produce several new arcade games in the early 1980s, and in 1984 he was appointed to lead the company's newly created video game division. During this same period, Nintendo began testing a sophisticated video game console that players could use at home with their televisions. This console, called the Nintendo Entertainment System, was introduced in 1986.

After assuming leadership of Nintendo's video game division, Miyamoto worked hard to create new video games that could be placed in arcades and eventually used on the Nintendo system. He spent the next few months studying new game ideas, but he kept returning to the character of Mario, who was known to video players all around the world. Miyamoto finally decided to give Mario a brother—Luigi—and build a new game around them.

Several months later, Miyamoto unveiled the *Super Mario Brothers* game. In this video game, Mario and Luigi chase unusual animals around a network of underground pipes deep beneath New York City. "I liked the idea of a game where creatures would move from top to bottom on screen and then back up again," Miyamoto explained. "When I thought about what kind of creatures those should be, turtles and crabs just seemed like a good fit. Since there are lots of pipes underground, I decided to use those for the creatures to move along. While I had never been to New York, I liked what I had seen of the city in movies and imagined that it must have a huge underground world that would be a perfect setting for the game."

Miyamoto's latest creation was another monster hit for Nintendo. Video players of all ages hurried to get their hands on the game, which established Mario and Luigi as two of the world's best-known cartoon characters. Nintendo rushed to take advantage of their popularity. Under Miyamoto's guidance, the company produced a series of sequels featuring the two characters. These games were widely hailed for their creativity and humorous qualities. Each game placed players in magical lands of secret trapdoors, flying turtles, dangerous dragons, magical vines, fabulous coins, and lovely princesses. "Many of Miyamoto's subsequent games not only had the same characters and roughly the same goals, but built on the skills that were learned in the preceding games," commented one industry observer. "There were many new lands and new tricks, and with them the sense of accomplishing new things, yet there was also the comfort of not having to learn a game from scratch."

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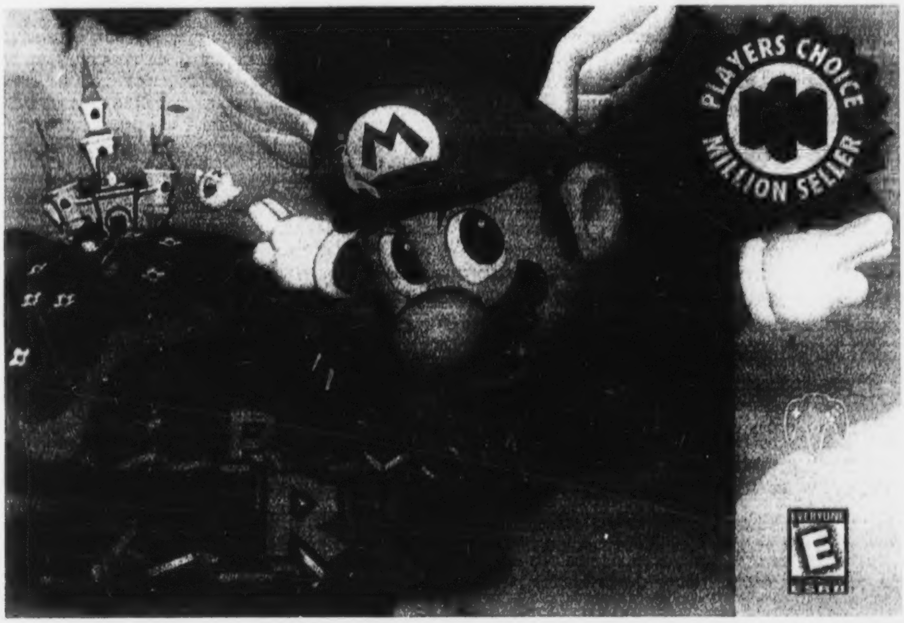
Super Mario Brothers and its sequels helped vault Nintendo to the top of the video game kingdom in the late 1980s. Between 1985 and 1991, Miyamoto produced eight Mario games that sold nearly 70 million copies. He also created several other extremely popular home video games during this time, including the *Adventures of Link, Starfox,* and *Yoshi's Island.* Finally, he supervised the production of countless other popular video games that were released under the Nintendo banner.

These successes established Miyamoto as the most successful video game designer in the world. In fact, by 1995, an estimated 13 percent of the games Nintendo sold worldwide were his games. In addition, total worldwide sales of Mario games in all formats had reached nearly $6 billion by 1995. But Miyamoto never thought about leaving the company, even though he could have made a fortune as an independent programmer. "I



have been like a freelance worker within Nintendo," he explained. "The freedom within the company kept me from leaving Nintendo. The company is just like a sponsor for my content."

Famous Figure in the Industry

By the 1990s, Miyamoto's many popular video game creations had transformed him into one of the most famous and respected people in the industry. "Shigeru Miyamoto is the one person who could be considered a god of game design," says Tom Hall, who helped create the games *Commander Keen* and *Doom*. "He has a complete and utter grasp of exactly what is 'fun.' He invented the side-scrolling platform game. How amazing is that? How seminal a game could *Super Mario 64* be? His approach to design, with your constant learning as you go, keeps the experience fresh throughout the game. It's not just more levels—it's whole new experiences that you are introduced to, new ways of doing things, which are then incorporated with your previous knowledge in an exciting combination. . . . Everyone has played Miyamoto games. His games are ubiquitous and wonderful, and I wish he'd clone himself so we could have even more. He's the single most influential game designer on this planet." According to Peter Molyneux, a creator of the PC video games *Populous* and *Dungeon Keeper*, "He is without doubt the greatest games designer in the world. No one else comes close."

Miyamoto in his office at Nintendo.

Other people in the video game industry, meanwhile, have marveled at the length of Miyamoto's career. "He's very unusual in that he's a game designer who started in the 1980s and is still at the cutting edge," said Steven Poole, author of *Trigger Happy: The Inner Life of Video Games.* "Twenty years and he hasn't done a bad game. He's unique in that he is creative and visionary but has the technological skills to understand what he wants from the hardware. . . . He's [also] a very friendly, modest guy, which is a blessed relief in the world of video games, where inflated egos tend to be attached to not much talent." His long-running career was also described by Hester Lacey, writing in the *Independent.* "[Video] developers refer to him, without any irony, as a 'god,' and the video gaming fraternity is highly conscious of the debt it owes him," Lester wrote. "For, 20-odd years ago, Miyamoto created not only *Super Mario* but *Donkey Kong.* In the process, he established the concept of the 'platform' game—the now standard format by which players progress from level to level, completing tasks as they go, copied in thousands of other games. He also invented the recognizable 'characters,' again now standard, and the forerunner of every other screen face, from Sonic the Hedgehog to Lara Croft. As if this weren't enough, he is still at the cutting edge of video-gaming technology." When his dominating position in the industry has been challenged by the other video game companies, Miyamoto has returned with more. "Each time it looked as if Nintendo was about to be undermined by piercing laser beams from the competition," Edward Rothstein wrote in the *New York Times*, "Miyamoto would invent yet another variation on a theme, sending the industry scrambling to produce imitations. He would use the latest gaming technology, not to create big-breasted heroines or show more vivid spurts of blood from crushed skulls, but to create nuanced, witty, and dazzling games that had even pretentious adults staying up late, ignoring glazed eyes and strained fingers."

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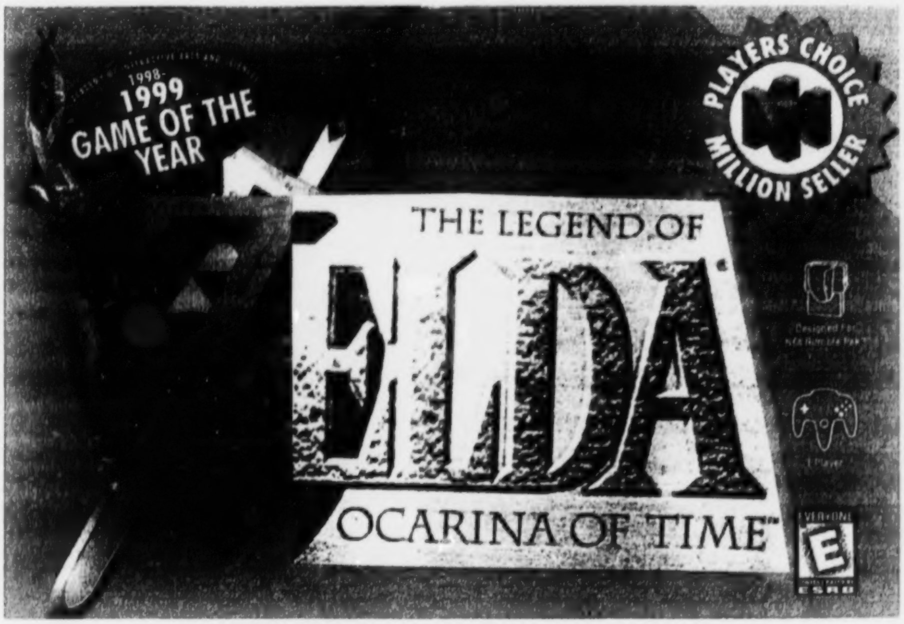
For his part, Miyamoto attributes his long-running success in creating popular video games to several factors. First, he feels that his games are popular because players feel an emotional connection to his characters. "When you draw a laughing face, your face should laugh," he said. "When you draw an angry face, your face should be angry. The character will capture your emotion." He also believes that his games tap into the same spirit of adventure that he felt when he explored the woods around his childhood home. Finally, Miyamoto thinks that his games challenge players to use their minds. "I want to entertain . . . in a fresh, surprising way," he said. "I like to make something in which the players develop their own ideas and vision. Rather than reward them for a single, correct answer, our games encourage them to think of alternatives that lead to different results. I want players to become creative and actively involved. I'm grateful that our games are selling well, considering that people often seek more passive forms of entertainment."

Miyamoto also has noted that his video games are not as violent and dark as some other games on the market. "We're very considerate of the fact that young kids play our games. And I try not to use violence as an easy means of expression," he said. "It's OK to use violence with quality and for a purpose, but I want to avoid using violence as an easy means just to seek stimulus. We don't have to use it if we have other creative means of expression." Miyamoto knows that some other video games feature senseless violence, however. For this reason, he encourages parents to monitor the video games and television shows that their children watch. "What's important is that the parents must have a close look at whatever media their children are facing, and from time to time control the activities their children are doing," he said. "Those who played *Super Mario Brothers* in their younger age are now becoming parents. . . . I hope more and more parents who have played video games have more understanding about what's good and bad."

> *"The best part [of my job] is that I can freely create games I enjoy, almost like an artist. The challenging part is figuring out how to create a game that people will understand. Sometimes we don't realize how difficult a certain part of the game is for general players, while other times we make parts too easy. Things don't always work out as I imagined. . . . You know, I joined Nintendo to make products that use ideas and intelligence, and they just turned out to be video games."*

Legend of Zelda: Ocarina of Time

In 1997 Miyamoto completed work on a video game that many people hailed as his greatest creation yet. This game, called *Legend of Zelda: Ocarina of Time,* was the fifth game in Nintendo's popular *Zelda* series. Developed over a three-year period, it required more than 140 game designers and $10 million before it was completed. "We all worked so hard to make the details as thorough as possible," explained Miyamoto. "It would have taken a lifetime to complete the product if we'd kept polishing the natural look of wind, ripples on the water, dust and so forth. And in 10 years' time, this will be old technology. But at this moment, what we've made is very close to the real world. And it looks beautiful because of the basic capabilities of Nintendo 64 [the company's new game system] and of our game designers."



Legend of Zelda: Ocarina of Time allows video game players to play the role of Link, an adventurous boy who travels through a series of fantastic universes and time periods as he tries to save the world of Hyrule from destruction. As soon as it was released, players from all over the world called it a thoroughly original masterpiece. "It was heralded by gamer geeks as the greatest video game of all time because of its use of narrative and mythology, its crisp, colorful 3-D graphics, its sound effects and music, its variety and depth," noted the *Toronto Star*. Within a month of its release, Miyamoto's latest creation sold 2.5 million copies. For his part, Miyamoto attributed the game's popularity to a simple fact: "We are simply making the games that we ourselves want to play."

Since the release of *Ocarina of Time*, Miyamoto has spent most of his time supervising teams of game designers who are developing new games for Nintendo. One such recent game was the popular *Zelda: Majora's Mask*, the latest game in the *Zelda* series. And he is said to be working on a new game of his own, which his many fans are eager to see. He has also contributed to the development of Game Cube, a new video game console that will be released by Nintendo in 2001. But despite his busy schedule, Miyamoto continues to love his job. "The best part is that I can freely create games I enjoy, almost like an artist," he said. "Designers of cars, on the other hand, can't do that because the company may not want to invest that much money in a new design or assembly plant. The challenging part

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is figuring out how to create a game that people will understand. Sometimes we don't realize how difficult a certain part of the game is for general players, while other times we make parts too easy. Things don't always work out as I imagined. . . . You know, I joined Nintendo to make products that use ideas and intelligence, and they just turned out to be video games."

MARRIAGE AND FAMILY

Miyamoto is married to Yasuko, a former Nintendo office worker. They have one son, Ray, and one daughter, Lui. Not surprisingly, their household includes plenty of video games. But Miyamoto places a firm limit on his children's video game activity. "I want my children to have a rich and varied life, not sit all day in the corner with a Game Boy," he stated.

> *Miyamoto places a firm limit on his children's video game activity. "I want my children to have a rich and varied life, not sit all day in the corner with a Game Boy."*

HOBBIES AND OTHER INTERESTS

Miyamoto is a sports fan who likes to swim and ride his bike to work. He also continues to play bluegrass music in his spare time. "It helps me to relax when I'm not dwelling on creating the next game," he explained. In addition, Miyamoto continues to enjoy exploring new places. Whenever he goes to an unfamiliar city, he always sets aside time to check out its stores, libraries, and museums.

HONORS AND AWARDS

Lifetime Achievement Award (Academy of Interactive Arts and Sciences): 1998

Japanese Ministry of International Trade and Industry Award (for career in multimedia): 1998

FURTHER READING

Books

Sheff, David. *Game Over: How Nintendo Zapped an American Industry, Captured Your Dollars, and Enslaved Your Children*, 1993

Periodicals

Computer Gaming World, Oct. 1997, p.289
Computer Retail Week, Oct. 20, 1997, Entertainment section
Denver Post, June 12, 1998, p.E12
Entertainment Weekly, Dec. 18, 1998, p.96
Independent (London), Sep. 17, 2000, p.4
Investor's Business Daily, May 18, 2000, p.A4
New York Times, Dec. 21, 1998, p.E2; Apr. 25, 1999, Section 3, p.2
Newsweek, Mar. 6, 1989, p.64
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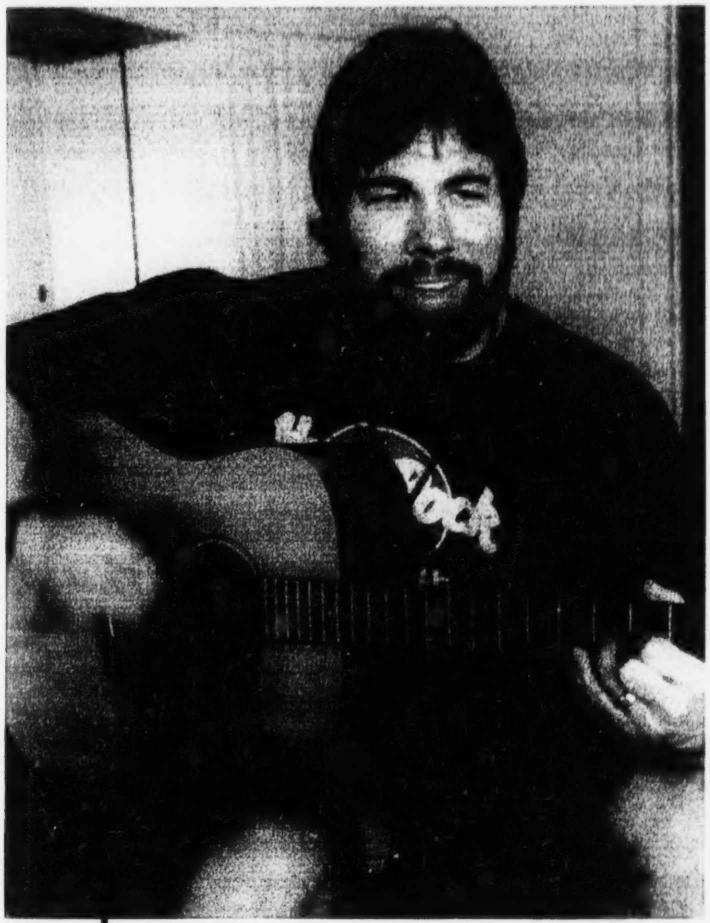
Times (London), May 29, 2000, Features section
Time Digital Magazine, Apr. 12, 1999 (online magazine http://www.time.com)
USA Today, Nov. 20, 1998, p.E2

ADDRESS

Nintendo of America
P.O. Box 957
Redmond, WA 98073

WORLD WIDE WEB SITE

http://www.nintendo.com



Steve Wozniak 1950-

American Computer Engineer
Co-Founder of Apple Computer and Creator of the Apple II Personal Computer

BIRTH

Stephen "Woz" Wozniak (pronounced WOZ-nee-ack) was born August 11, 1950, in San Jose, California. His parents were Jerry Wozniak, an aerospace engineer, and Margaret Wozniak. He has one younger sister, Leslie, and one younger brother, Mark.

YOUTH

Wozniak grew up in Sunnyvale, California, an affluent community located in the state's Santa Clara Valley. This valley emerged as a center of high-technology research and manufacturing during the 1950s and 1960s. In fact, this region became so closely associated with the electronics industry that it acquired the nickname "Silicon Valley." This is a reference to the element silicon's electrical properties and its importance in the development of new electronic products.

As a youngster, Wozniak had many of the same interests as other boys his age. He enjoyed sports like tennis and swimming, and he participated in Little League Baseball. He also was a big fan of suspenseful television programs like the spooky "Twilight Zone" and the spy drama "The Man from UNCLE."

But Wozniak was also fascinated by the worlds of electronics and computers. He spent hours reading books and magazines about new computer innovations, software programs, and electronic products. He even pored over his father's thick engineering textbooks and periodicals for new information on computer programming or electronic circuitry. By the time Wozniak was 11 or 12 years old, the walls of his bedroom were decorated with pictures of computers and futuristic electronic devices.

> *"My life was fun electronics projects. I was motivated by any chance I got to build things of my own design."*

As Wozniak's interest in electronics deepened, he put his growing knowledge of the subject to use on a wide range of projects. At age 12, he built his own amateur "ham" radio and earned an operator's license. This enabled him to spend many evenings talking with fellow ham radio operators all around the world. He also designed dozens of computers and countless software programs during his teen years, even though he did not have the money to make any of his designs a reality. But he did produce an array of other electronic gadgets of various shapes and sizes. Some of these were created for science fairs, but he built most of them for his own enjoyment. "My life was fun electronics projects," Wozniak recalled. "I was motivated by any chance I got to build things of my own design." As time passed, admiring friends dubbed him "Woz the Wiz" in recognition of his many electronic inventions. The "Woz" nickname stuck, and it has stayed with him throughout his adult life.

"Steve was a study in contradictions," wrote biographer Martha Kendall. "He was shy and socially awkward and didn't want to call attention to himself; yet he did things that were guaranteed to get him noticed. Some of these actions were commendable, as when he aced his schoolwork and won academic honors. Other activities were mischievous or downright illegal."

By the time Wozniak reached high school, he knew that he wanted to pursue some sort of career in electronics and mechanical engineering. But he also hoped to try his hand at teaching someday. "I always wanted to do what I can be most successful and productive at," he explained. "I have had a lifetime interest in both computers and in the importance of teaching. In sixth grade I told my dad that I wanted to be an engineer like himself but that secondly I wanted to teach fifth grade."

EDUCATION

High School Years

Wozniak attended public school in Cupertino, a neighboring town in the Santa Clara Valley. By the time he entered Cupertino's Homestead High School in 1964, he had gained a reputation among both teachers and peers as a bright but odd young man. "Steve was a study in contradictions," wrote biographer Martha Kendall. "He was shy and socially awkward and didn't want to call attention to himself; yet he did things that were guaranteed to get him noticed. Some of these actions were commendable, as when he aced his schoolwork and won academic honors. Other activities were mischievous or downright illegal."

In fact, Wozniak's love of practical jokes and pranks often threatened to overshadow his good grades and his positive activities within Homestead High, such as his presidency of the school's electronics and math clubs. At one point, for instance, he was suspended for two days and forced to spend a night in a juvenile jail for creating a bomb scare within the school. These incidents troubled his parents. They feared that their brilliant son's outrageous practical jokes threatened his future. "I knew my son would either be rich or wind up in jail," his mother said years later.

During his high school years, Wozniak spent most of his free time with a small group of students who shared his excitement about electronics and computers. In fact, this gang of so-called "computer nerds" became his primary social circle at Cupertino. Wozniak felt comfortable and at ease among them, and he enjoyed their company. But he also stuck close to this group because he lacked confidence to interact with other groups in the school. "The computer nerd is an outsider," he stated. "He doesn't learn the normal ways of getting along with people in a social sense. . . . They can go have pizza and talk among themselves, and everything seems fine. But, for some reason, if they go out with other kinds of people, they don't know how to act or what to order or how to get appreciative comments." Wozniak graduated from Homestead High School in 1968.

College Years

After graduating from high school, Wozniak hoped to continue his education at California Tech. When the school rejected his application, he enrolled at the University of Colorado in Boulder. After arriving at Boulder, however, he did not pay much attention to his studies. Instead, he spent most of his time pursuing his own computer and electronics projects.

Many of Wozniak's pet projects stemmed from his continued enthusiasm for practical jokes. For example, during his freshman year he built a small handheld device that could jam television signals. He then wandered down to the dormitory television room, where dozens of students were watching a program. He silently used his device to mess up the reception, prompting loud protests from the crowd. Several students tried to adjust the antenna to correct the picture, but Wozniak continued to control the television secretly from the back of the room. His trickery eventually prompted the students to call a television repairman, who told them that they needed a new set.

After one year in Colorado, Wozniak returned to Sunnyvale and got a job as a programmer for a small computer company called Tenet. His love for electronics and computers kept him busy on various projects both in and out of the workplace. Still, he did not abandon college altogether. In the fall of 1969 he began taking some classes at DeAnza Community College, a local school in the Santa Clara Valley.

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Then, one year later, he transferred to the University of California at Berkeley to continue his engineering studies.

Wozniak stayed at UC-Berkeley until the end of his junior year, when he took a summer job with the Hewlett-Packard computer company. As it turned out, however, his temporary break from college stretched out for nearly a decade. He did not return to Berkeley to resume his schooling until 1981, some ten years after he left school and five years after he and Steve Jobs launched their famous Apple Computer Company. "I never dropped out of college," he explained. "I simply took a year off to earn money for my fourth year of school. And then my career kept going up. I worked for a year that turned into 10 years."

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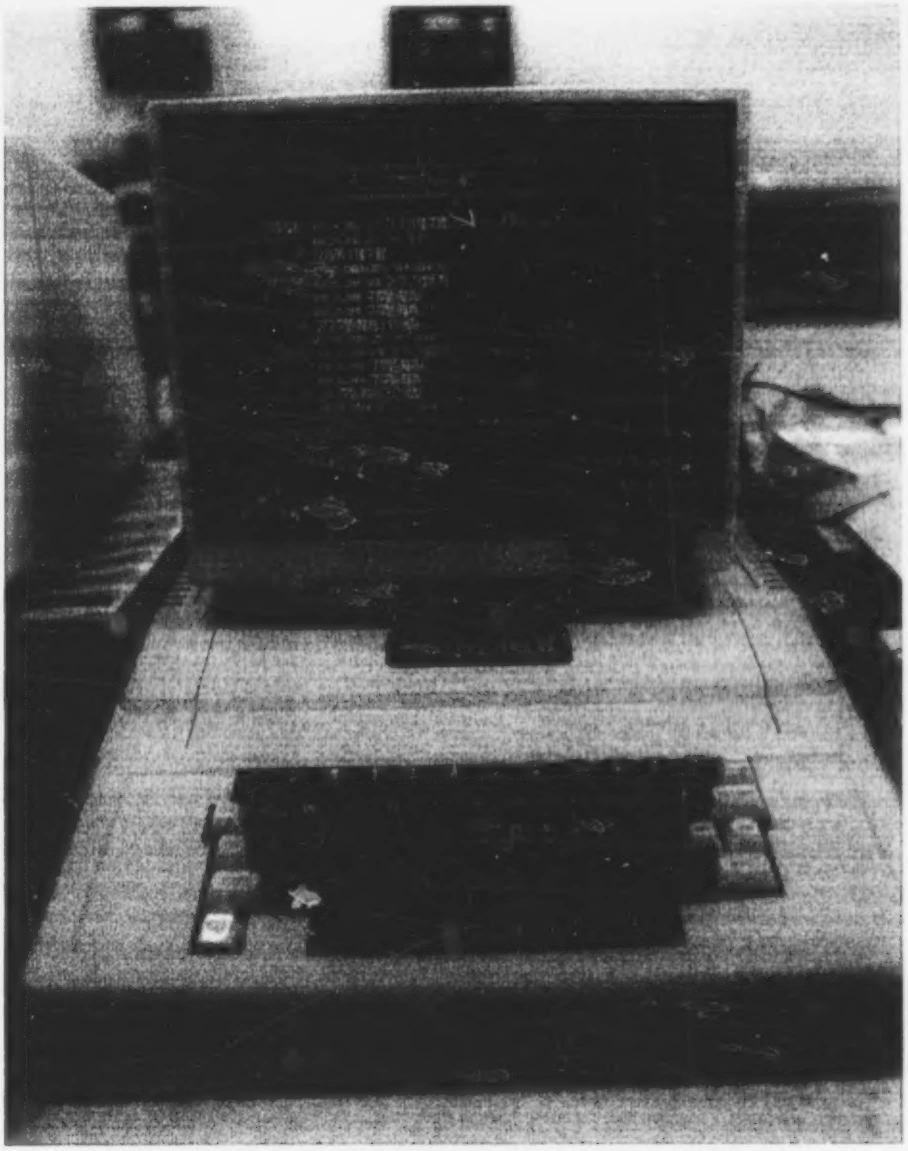
By the time Wozniak returned to Berkeley, his work with Apple had made him one of the most famous names in American business. Mindful of this, he enrolled under the name of Rocky Raccoon Clark, combining the name of his dog (Rocky Raccoon) with his second wife's family name (Clark) so that he wouldn't receive any special attention from classmates, instructors, or reporters. Wozniak finally earned his master's degree in engineering from the University of California at Berkeley in 1986. Not surprisingly, he was valedictorian of his graduating class.

CAREER HIGHLIGHTS

Wozniak and Jobs Join Forces

Wozniak's career as a computer engineer blossomed during the early 1970s. During the summer of 1970, after his junior year at UC-Berkeley, he began working at Hewlett-Packard, a well-known high-technology company, in order to earn money to continue his education. At the same time, however, he spent his evenings and weekends exploring his own computer designs. In fact, he spent much of the summer of 1970 working with his friend Bill Fernandez in the Fernandez family garage on new computer ideas.

It was during one of these hot summer evenings out in the garage that Wozniak first met Fernandez's friend Steve Jobs (see the entry on Jobs in this volume). At the time, Jobs was an intense 15-year-old boy who



The Apple II computer.

shared Wozniak's fascination with computer technology. Before long, the two young men were spending hours together talking about the future of computer design and tinkering with electronics projects. In fact, they joined forces to become two of the world's first computer hackers. Within a few months of meeting one another, they collaborated to create electronic devices that enabled people to tap into phone company computers

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to make free long distance telephone calls. On one occasion, Wozniak and Jobs even called the Vatican in an attempt to talk to the pope. These antics appealed to their shared love for practical jokes and technological challenges. But such actions could have eventually landed them in serious trouble with the law. Fortunately, they soon abandoned these illegal activities in order to concentrate their energies and talents on new computer innovations.

As the 1970 fall semester drew near, Wozniak decided to stay at Hewlett-Packard instead of returning to college. "I originally planned to take a year off from Berkeley after my third year to earn enough money as a technician for my final year of college," said Wozniak. "But my career kept advancing. . . . I got into [computer] chip layout and things like that, and basically my career kept moving, my interests in life were changing, and it was too far to commute to Berkeley." In the meantime, Jobs took a programming position at Atari, a video game company. During his employment at Atari, Jobs stayed in close contact with Wozniak. In fact, he even arranged for Wozniak to design a new computer game for Atari in exchange for a $700 payment.

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In 1975 Wozniak and Jobs joined the Homebrew Computer Club. This loosely organized group consisted of local programmers and engineers who enjoyed getting together to talk about computers, programming software, and electronics. Wozniak attended nearly every meeting, even though his shyness kept him from contributing to the general conversation. As the months passed by, the enthusiasm of his fellow club members became a source of inspiration to him. He decided to build a new computer system that would incorporate all of the computer industry's latest technological advances into one simple machine that could fit on a desktop.

First, Wozniak wrote a detailed software program for his computer, even though the actual machine did not exist yet. He then began the process of

Wozniak tinkering with computer hardware in his office at Apple, 1984.

designing and building a personal computer that his software could run on, using inexpensive and easy-to-find components. "I just built a computer because I couldn't afford to buy one," he later explained. Once he completed his computer and installed the software, he showed it to Jobs and the other members of the Homebrew Computer Club. Everyone was very impressed with Wozniak's invention, but Jobs was particularly dazzled. In fact, he convinced his friend that they should establish a company to sell the computer system.

Creation of Apple Computer Company

Within a matter of weeks, the two young men set up shop in Jobs' parents' garage. During this time, they considered and discarded several business names for their new venture. Finally, Jobs suggested that they call their new company Apple, after the apple orchards that he had worked in during his youth. Wozniak liked the name, and in April 1976 the Apple Computer Company formally opened its doors. At that time, Wozniak was responsible for computer and software design, even though he was still working full-time at Hewlett-Packard. Jobs, meanwhile, was in charge of marketing, sales, and other business aspects of the operation. A few weeks later, a local computer shop placed an order for $50,000 worth of Wozniak's computers. "Nothing was ever so great and so unexpected," Wozniak remembered. "It was unbelievable." In fact, he later called that day the happiest moment of his entire Apple experience.

The next few months were frantic ones for both Wozniak and Jobs. They were forced to borrow money to build and deliver the ordered computers on time. But the $50,000 payment they received for those first computers — called the Apple 1 — enabled them to expand the company's marketing and research work.

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> *Wozniak admits that he had no idea that the Apple II would be so influential. "I envisioned the project as a minor commercial success because back then the first computers were mostly designs and chips on a board, and I knew how superior ours was compared to any others. I did not think that personal computers would become so huge as to lead to a start-up company being worth $500 million in five years."*
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> *"*

Over the next several months, Wozniak spent nearly every evening and weekend working on improvements to the Apple 1 computer. In the meantime, Jobs tried to convince businessman Mike Markkula to join the company as a business partner and manager. Jobs knew that Markkula's managerial experience and his ability to recruit investors could be quite valuable to the company. But Markkula said that he would not join Apple unless Wozniak resigned from his job at Hewlett-Packard and dedicated all his energy to the new venture.

Wozniak initially refused to agree to Markkula's conditions. He liked the security of his job at Hewlett-Packard. In addition, he had recently gotten married, and his wife worried that their marriage might fail if he spent all of his time working on the Apple business. Finally, Wozniak did not want to have any responsibility for managing any aspect of the company's operations. But Jobs and Markkula assured Wozniak that his sole responsibility would be to build better computers. They also convinced him that Apple was poised on the brink of tremendous financial success. Wozniak finally agreed to leave Hewlett-Packard and work full-time at Apple.

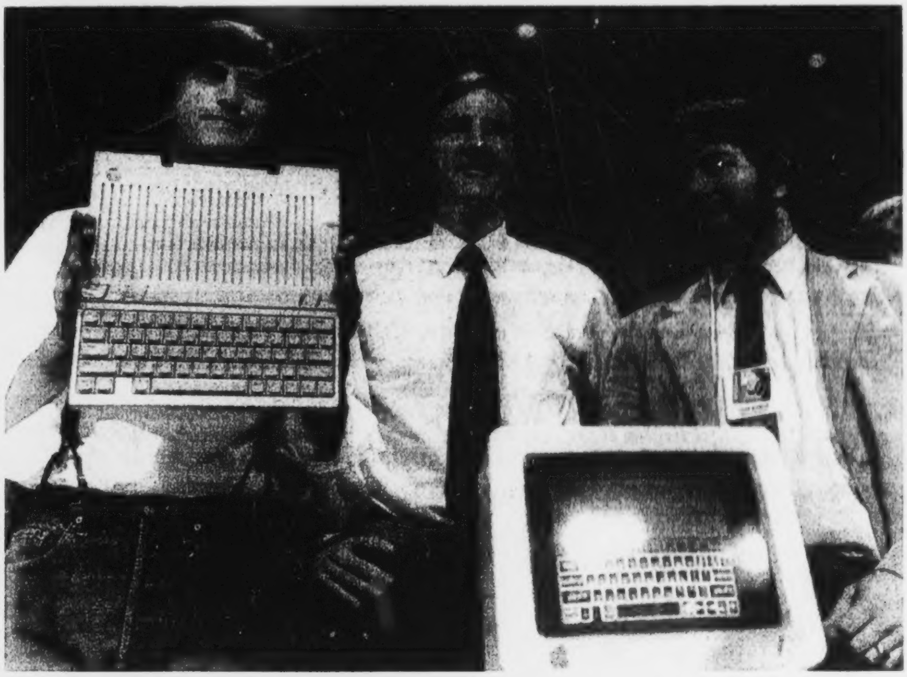
In January 1977 Apple officially incorporated and opened new offices in Cupertino. Wozniak spent nearly all of his time at the offices, working on improvements to his first Apple computer. A few months later, he unveiled the Apple II computer. This machine was the first fully assembled programmable computer small enough to fit on a table or desk. It included many innovative features guaranteed to delight computer users. For example, Wozniak's creation included a high-resolution color video display, a cassette-tape interface, and a built-in keyboard. It also featured a plastic case and a built-in speaker for sound. None of these features had ever before been included in a computer that was so easy to use and inexpensive to buy.

Today, Wozniak's Apple II computer is regarded as the world's first personal computer. In fact, many observers claim that his machine triggered the birth of the entire personal computer industry. Wozniak admits that he had no idea that the Apple II would be so influential. "I envisioned the project as a minor commercial success because back then the first computers were mostly designs and chips on a board, and I knew how superior ours was compared to any others," he said. "I did not think that personal computers would become so huge as to lead to a start-up company being worth $500 million in five years."

Apple's Success Brings Riches

Within weeks of its 1977 release, it became clear that the Apple II computer was going to be a huge success. In fact, Apple registered $2 million in sales by the end of the year, as computer enthusiasts all around the world rushed to purchase a machine of their own. But Wozniak and the rest of the Apple crew were not content to relax and watch the money roll in. Instead, they continued to look for new improvements they could make. For instance, Wozniak and a fellow programmer named Randy Wigginton devised a flexible disk drive that could read software programs and information from a floppy diskette instead of a cassette tape. By June 1978, all Apple II computers featured this new flexible disk drive. This innovation was very important because it enabled users to create and store more complex business and word processing computer programs than ever before. It also encouraged many other companies to develop software for the Apple II computer. Today, the creation of the flexible disk drive is widely hailed as an important factor in the development of the international software industry.

As the months passed by, the continued popularity of the Apple II enabled the company to greatly expand its operations. It also made Apple a very



Wozniak (right), John Sculley (center), and Steven Jobs (left) pose as they unveil the new Apple IIc in April 1984.

successful company financially. Within six years of opening, the company was worth an estimated $6 billion. Apple's success made Wozniak, Jobs, and Markkula very wealthy. But the company's founders were not the only ones who reaped great riches from the Apple II. In fact, by December 1980, the Apple II's popularity had transformed more than 40 Apple employees and investors into millionaires.

Wozniak Leaves Apple

The early 1980s proved to be a period of great change for Wozniak. In 1980 his first marriage ended in divorce. He gave up millions of dollars of Apple stock in the divorce settlement, but the company's success still left him a very wealthy man. For example, he was able to buy a mansion in the Santa Cruz Mountains, where he kept a small herd of llamas and numerous other exotic pets. He also bought a small plane and earned a pilot's license so that he could fly it all around the country.

In February 1981 Wozniak and his new fiancé, Candi Clark, made plans to fly his small plane to San Diego, where they would pick up their wedding rings. But the plane crashed on the runway, and both Wozniak and Clark were seriously injured. Clark suffered numerous broken bones in her face and one hand. Wozniak suffered a head injury that affected his short-term memory. "For about five weeks I had a type of amnesia that prevents you from forming any new long-term memories," he said. "After I recovered, people would show me pictures of myself in the hospital, playing games with my computer with my face all battered up. They would tell me stories of how I tried to sneak out of the hospital . . . or how I went to parties and rode my motorcycle. I didn't remember any of that. I had all of my old memories, but I'd forget new things from one day to the next. Finally I came out of it one night, but I never got those memories back." Several months later, investigators blamed the crash on pilot error.

Back at Apple, meanwhile, the company introduced a new computer called the Macintosh. This computer model was seen as a replacement for the Apple II. During this time, relations between Wozniak and Jobs became very strained. At the same time, Wozniak expressed dissatisfaction with the company's changing size and atmosphere. "The company had become big business, and I missed tinkering. I just wanted to be an engineer," he recalled. "We had a hundred engineers at that point, and I was no longer really important to the company. I didn't want to be a manager; I was just an engineer, and I wasn't really needed there. . . . The plane crash was a good excuse [to take a leave of absence]." From this point forward, Wozniak engaged in only limited engineering work for Apple.

"

Wozniak eventually became dissatisfied with the company's changing size and atmosphere. "The company had become big business, and I missed tinkering. I just wanted to be an engineer. We had a hundred engineers at that point, and I was no longer really important to the company. I didn't want to be a manager; I was just an engineer, and I wasn't really needed there. . . . The plane crash was a good excuse [to take a leave of absence]."

"

Soon after Wozniak left Apple's day-to-day operations, he decided to organize a massive outdoor music festival. He believed that if the festival was planned properly, people would see it as an opportunity to gather together in a spirit of brotherhood. "Maybe we can realize that one of the ways to take care of ourselves is to think of all of us as a whole," Wozniak explained.

This three-day concert, called the US Festival, was held in Devore, California, on Labor Day weekend in 1982. It featured many of the country's hottest musical acts, including Fleetwood Mac, the Grateful Dead, Jackson Browne, Tom Petty, Herbie Hancock, and the Police.

One year later, Wozniak organized a second US Festival featuring many of the same musicians. But when the concert concluded, he indicated that neither of the two festivals created the sense of unity and fellowship that he had been hoping for. Observers, meanwhile, pointed out that the festivals had been financial failures. They even charged that some people associated with the festivals took advantage of Wozniak's trusting nature to benefit themselves financially. But even though he lost an estimated $20 million on the two festivals, Wozniak insisted that financial factors did not influence his decision to end the concerts. "I don't feel attached to my money in normal ways," he said.

> *"Teaching computer [skills] was the most appropriate thing for me to get into. At a point in time I was donating [computer] labs to all the local schools. But I felt guilty that I was giving computers but not myself. So I started teaching a few kids, then more, then even more."*

In 1985 Wozniak formally resigned from Apple, selling his stock in the company for an estimated $70 million. He then formed a new company called CL9 in hopes of designing a universal remote-control device that could replace all the individual remote-control devices that people used for televisions, VCRs, and stereos. "I wanted a computer, so I designed the Apple," he explained. "I live in a house with lots of televisions and VCRs, and I wanted a single unit to control them all, so I formed [CL9]." One year later, Wozniak agreed to merge his company into another firm, called Tech Force, that manufactured toy robots operated by remote-control devices. Wozniak said that the company would be "dedicated to teaching children of all ages to live with and love technology." But Tech Force was unable to turn a profit, and Wozniak and the other owners quietly closed its doors in 1990.

Building His Dream House

In the late 1980s Wozniak and his wife Candi moved into a huge house in the foothills of the Santa Cruz Mountains near San Jose. They then launched a major renovation of the house, adding all sorts of rooms and

Wozniak working with sixth- and seventh-grade students during an after-school computer class.

features that appealed to Wozniak's playful nature. For example, one section of the house was transformed into an artificial cave, complete with dinosaur footprints, fossils, and an entranceway behind a waterfall. Other rooms were devoted to video games, computers, and movie watching. "The whole house has to be for kids as well as adults," he stated. "Kids just love secret places." Once the renovation was completed, Wozniak planned a massive housewarming party. He decorated the house with 100,000 helium balloons and hired magicians, comedians, children's theater performers, musicians, and clowns for the festivities. He then invited about 1,000 people — including 250 children — to the party, which was a resounding success.

In 1990 Wozniak's marriage to his second wife ended in divorce. Several months later he married Suzanne Mulkern. Both Wozniak and Mulkern had three children from previous marriages, so their new family was a big one. But he was delighted with the arrangement, for he had always wanted lots of children.

Community Involvement

Wozniak spent lots of time traveling and hanging out with his family in the early 1990s. But as time passed, he began to feel that he should make greater use of his talents. "I decided that I wanted to give a lot of myself to helping young people's minds develop," he explained. With this in mind, he began volunteering his time to a kindergarten classroom in the nearby community of Los Gatos. A few months later, he lent his expertise and financial assistance to local school district officials when they were faced with major decisions about computer equipment purchases.

Wozniak's experiences in the kindergarten classroom rekindled his long-dormant interest in being a teacher. By the mid-1990s, he was leading several computer and technology courses for elementary school children in Los Gatos. He taught primarily fifth-graders, just as he had dreamed of doing back when he was a youngster himself. "Teaching computer [skills] was the most appropriate thing for me to get into," he explained. "At a point in time I was donating [computer] labs to all the local schools. But I felt guilty that I was giving computers but not myself. So I started teaching a few kids, then more, then even more."

"I often wonder why I remained the person I always wanted to be, from late high school on," he states on his Web site. "I wanted to be an engineer and then a fifth-grade teacher and I wanted a computer someday and I wanted to be nice to people and I wanted to tell and make jokes and I wanted a family and home. It couldn't have come truer for me."

Wozniak also continues to follow the computer industry. Indeed, he has watched the fortunes of his old company Apple with particular interest over the years (Apple currently sells about $7 billion worth of computers and software annually). But he freely admits that he does not fit into the modern computer industry. Instead, he is content to make occasional speeches on technology issues and tinker with his own World Wide Web site. This Web site gives visitors the ability to exchange e-mail with Wozniak and read about his views on new computer technology, software, and games. It even gives visitors the option of looking into his daily activities through "WozCam" video cameras that are installed throughout his home.

Finally, Wozniak's Web site assures visitors that the inventor of the Apple II computer remains a very happy man. "I often wonder why I remained the person I always wanted to be, from late high school on," he states on his site. "I wanted to be an engineer and then a fifth-grade teacher and I want-

Wozniak leading a conga line of his sixth- and seventh-grade students, each carrying a computer that he bought for them.

ed a computer someday and I wanted to be nice to people and I wanted to tell and make jokes and I wanted a family and home. It couldn't have come truer for me."

Advice to Young People

Wozniak offers this advice to young people. "Find something you are good at, work on it, and eventually you can succeed and make your life. Don't just slack off and think you will just go through life doing a job. You should try to do incredible things — put a lot of hours into making a lot of things very, very good. . . . You have a lot of free time when you are young, so put it into what you are good at before you wind up with a life with many commitments, meetings, bills, and mortgages. Spend time when you are young, and that will give you a lot more freedom when you are older."

MARRIAGE AND FAMILY

Wozniak's first marriage, to Alice Robertson, lasted from 1976 to 1980. After their divorce, he married Candi Clark, a former Olympic kayaker who worked as a financial analyst at Apple. They had three children —

Jesse, Gary, and Sara — before they were divorced in 1990. Later that year, Wozniak married Suzanne Mulkern, an attorney. He is stepfather to Mulkern's children, Adam, Daniel, and Marci.

HOBBIES AND OTHER INTERESTS

Wozniak has donated an estimated $7 million to charities over the years. He continues to enjoy computer games and learning about new computer technology, but he also spends lots of time listening to rock music and following professional basketball.

HONORS AND AWARDS

Grace Murray Hopper Award (Association for Computing Machinery): 1979
National Medal of Technology: 1985
Information Processing Technology Hall of Fame: 1992
National Inventors Hall of Fame: 2000

FURTHER READING

Books

Beers, David. *Blue Sky Dream: A Memoir of America's Fall from Grace,* 1996
Garr, Douglas. *Woz: The Prodigal Son of Silicon Valley,* 1984
Gold, Rebecca. *Steve Wozniak: A Wizard Called Woz,* 1994 (juvenile)
Kawasaki, Guy. *Hindsights: The Wisdom and Breakthroughs of Remarkable People,* 1993
Kendall, Martha E. *Steve Wozniak: Inventor of the Apple Computer,* 1994
Northrup, Mary. *American Computer Pioneers,* 1998 (juvenile)
200 Most Popular Scientists for Young Adults, 1999 (juvenile)
Who's Who in America, 2001

Periodicals

Business Journal-San Jose, Mar. 18, 1986, p.13
Business Week, Oct. 7, 1985, p.67
Byte, Dec. 1984, p.67; Jan. 1985, p.167
Chicago Tribune, Jan. 2, 1985, p.C1; May 25, 1986, p.C1; Feb. 9, 1998, p.C2
Computer Reseller News, Nov. 15, 1998, p.53
Current Biography 1997
Datamation, Apr. 1, 1985, p.135
InfoWorld, Oct. 1, 1984, p.55; Oct. 8, 1984, p.50

Los Angeles Times, May 14, 1986, View section, p.1
New York Times, Mar. 29, 1990, p.C1
Newsweek, Feb. 18, 1985, p.66
People, May 30, 1983, p.89; Feb. 14, 1994, p.61
U.S. News and World Report, Dec. 27, 1999, p.60
USA Today, Dec. 26, 1990, p.B5
Wired, Sep. 1998, p.118

WORLD WIDE WEB SITES

http://www.woz.org
http://invent.org/book/book-text/wozniak.html

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How to Use the Cumulative Index

Our indexes have a new look. In an effort to make our indexes easier to use, we've combined the Name and General Index into a new, cumulative General Index. This single ready-reference resource covers all the volumes in *Biography Today,* both the general series and the special subject series. The new General Index contains complete listings of all individuals who have appeared in *Biography Today* since the series began. Their names appear in bold-faced type, followed by the issue in which they appear. The General Index also includes references for the occupations, nationalities, and ethnic and minority origins of individuals profiled in *Biography Today*.

We have also made some changes to our specialty indexes, the Places of Birth Index and the Birthday Index. To consolidate and to save space, the Places of Birth Index and the Birthday Index will no longer appear in the January and April issues of the softbound subscription series. But these indexes can still be found in the September issue of the softbound subscription series, in the hardbound Annual Cumulation at the end of each year, and in each volume of the special subject series.

General Series

The General Series of *Biography Today* is denoted in the index with the month and year of the issue in which the individual appeared. Each individual also appears in the Annual Cumulation for that year.

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Special Subject Series

The Special Subject Series of *Biography Today* are each denoted in the index with an abbreviated form of the series name, plus the number of the volume in which the individual appears. They are listed as follows.

Adams, Ansel	Artist V.1	(Artists Series)
Cooney, Barbara	Author V.8	(Author Series)
Fanning, Shawn	Science V.5	(Scientists & Inventors Series)
Jones, Marion	Sport V.5	(Sports Series)
Peterson, Roger Tory	WorLdr V.1	(World Leaders Series: Environmental Leaders)
Sadat, Anwar	WorLdr V.2	(World Leaders Series: Modern African Leaders)
Wolf, Hazel	WorLdr V.3	(World Leaders Series: Environmental Leaders 2)

Updates

Updated information on selected individuals appears in the Appendix at the end of the *Biography Today* Annual Cumulation. In the index, the original entry is listed first, followed by any updates.

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Morissette, Alanis – *Ottawa, Ontario* Apr 97
Mowat, Farley – *Belleville, Ontario* .... Author V.8
Priestley, Jason – *Vancouver, British Columbia* .... Apr 92
Shatner, William – *Montreal, Quebec* Apr 95
Twain, Shania – *Windsor, Ontario* . . . Apr 99
Vernon, Mike – *Calgary, Alberta* ..... Jan 98
Watson, Paul – *Toronto, Ontario* . . WorLdr V.1
Wolf, Hazel – *Victoria, British Columbia* .... WorLdr V.3
Yzerman, Steve – *Cranbrook, British Columbia* .... Sport V.2

China
Dai Qing – *Chongqing* .... WorLdr V.3
Fu Mingxia – *Wuhan* .... Sport V.5
Lucid, Shannon – *Shanghai* .... Science V.2
Paterson, Katherine – *Qing Jiang, Jiangsu* .... Author 97
Pei, I.M. – *Canton* .... Artist V.1
Wang, An – *Shanghai* .... Science V.2

Colorado
Allen, Tim – *Denver* .... Apr 94
Bryan, Zachery Ty – *Aurora* .... Jan 97
Handler, Ruth – *Denver* .... Apr 98
Stachowski, Richie – *Denver* . . . Science V.3
Toro, Natalia – *Boulder* .... Sep 99
Van Dyken, Amy – *Englewood* . . . Sport V.3

Connecticut
Brandis, Jonathan – *Danbury* .... Sep 95
Bush, George W. – *New Haven* ..... Sep 00
dePaola, Tomie – *Meriden* ..... Author V.5
Land, Edwin – *Bridgeport* ...... Science V.1
Leibovitz, Annie – *Waterbury* ...... Sep 96
Lobo, Rebecca – *Hartford* .... Sport V.3
McClintock, Barbara – *Hartford* ..... Oct 92
Spock, Benjamin – *New Haven* ..... Sep 95

Cuba
Castro, Fidel – *Mayari, Oriente* ...... Jul 92
Estefan, Gloria – *Havana* .... Jul 92
Fuentes, Daisy – *Havana* .... Jan 94
Hernandez, Livan – *Villa Clara* ..... Apr 98
Zamora, Pedro .... Apr 95

Czechoslovakia
Albright, Madeleine – *Prague* ...... Apr 97
Hasek, Dominik – *Pardubice* ..... Sport V.3

Hingis, Martina – *Kosice* . . . . Sport V.2
Jagr, Jaromir – *Kladno*. . . . . Sport V.5
Navratilova, Martina – *Prague* . . . . . . Jan 93
Dominican Republic
Martinez, Pedro – *Manoguayabo*. . Sport V.5
Sosa, Sammy –*San Pedro de Macoris*. . Jan 99
Egypt
Arafat, Yasir – *Cairo* . . . . Sep 94
Boutros-Ghali, Boutros – *Cairo*. . . . . Apr 93
Sadat, Anwar – *Mit Abu al-Kum*. . . . . WorLdr V.2
England
Amanpour, Christiane – *London* . . . . Jan 01
Attenborough, David – *London*. . Science V.4
Diana, Princess of Wales – *Norfolk* . . Jul 92; Jan 98
Goodall, Jane – *London* . . . . Science V.1
Handford, Martin – *London* . . . . Jan 92
Hargreaves, Alison – *Belper* . . . . Jan 96
Hawking, Stephen – *Oxford* . . . . Apr 92
Herriot, James – *Sunderland*. . . . Author V.1
Jacques, Brian – *Liverpool* . . . . . . Author V.5
Leakey, Mary – *London* . . . . Science V.1
Macaulay, David – *Burton-on-Trent* . . . . Author V.2
Moore, Henry – *Castleford*. . . . . . . Artist V.1
Pottter, Beatrix – *London* . . . . . . Author V.8
Reid Banks, Lynne – *London* . . . Author V.2
Rowling, J. K.– *Bristol*. . . . . Sep 99
Sacks, Oliver – *London* . . . . Science V.3
Stewart, Patrick – *Mirfield*. . . . . Jan 94
Winslet, Kate – *Reading* . . . . Sep 98
Ethiopia
Haile Selassie – *Ejarsa Goro, Harar* . . . . WorLdr V.2
Roba, Fatuma – *Bokeji* . . . . Sport V.3
Florida
Carter, Vince – *Daytona Beach*. . . . Sport V.5
Dorough, Howie – *Orlando*. . . . . Jan 00
Evert, Chris – *Ft. Lauderdale* . . . . . Sport V.1
McLean, A.J. – *West Palm Beach*. . . . . Jan 00
Reno, Janet – *Miami*. . . . . Sep 93
Richardson, Dot – *Orlando* . . . . . . Sport V.2
Robinson, David – *Key West* . . . . Sep 96
Sanders, Deion – *Ft. Myers* . . . . . . Sport V.1
Sapp, Warren – *Plymouth* . . . . Sport V.5
Smith, Emmitt – *Pensacola*. . . . . Sep 94
Tarvin, Herbert – *Miami* . . . . Apr 97
France
Cousteau, Jacques – *St. Andre-de-Cubzac* . . . . Jan 93
Ma, Yo-Yo – *Paris*. . . . . Jul 92
Georgia
Carter, Jimmy – *Plains* . . . . Apr 95
Grant, Amy – *Augusta*. . . . . Jan 95
Hogan, Hulk – *Augusta* . . . . Apr 92
Johns, Jasper – *Augusta* . . . . Artist V.1
Lee, Spike – *Atlanta* . . . . Apr 92
Robinson, Jackie – *Cairo* . . . . Sport V.3
Thomas, Clarence – *Pin Point*. . . . . . . Jan 92
Tucker, Chris – *Decatur*. . . . . Jan 01
Ward, Charlie – *Thomasville* . . . . Apr 94
Germany
Bethe, Hans A. – *Strassburg*. . . . Science V.3
Frank, Anne – *Frankfort* . . . . Author V.4
Galdikas, Biruté – *Wiesbaden* . . . Science V.4
Graf, Steffi – *Mannheim* . . . . Jan 92
Pippig, Uta – *Berlin* . . . . Sport V.1
Ghana
Annan, Kofi – *Kumasi* . . . . Jan 98
Nkrumah, Kwame – *Nkrofro*. . . WorLdr V.2
Guatemala
Menchu, Rigoberta – *Chimel, El Quiche* . . . . Jan 93
Haiti
Aristide, Jean-Bertrand – *Port-Salut*. . . Jan 95
Hawaii
Case, Steve – *Honolulu* . . . . Science V.5
Lowry, Lois – *Honolulu* . . . . Author V.4
Tuttle, Merlin – *Honolulu* . . . . Apr 97
Holland
Lionni, Leo – *Watergraafsmeer* . . . . Author V.6
Hungary
Erdös, Paul – *Budapest* . . . . Science V.2
Idaho
Street, Picabo – *Triumph* . . . . Sport V.3
Illinois
Anderson, Gillian – *Chicago*. . . . . Jan 97
Blackmun, Harry – *Nashville* . . . . Jan 00
Boyd, Candy Dawson – *Chicago*. Author V.3
Bradbury, Ray – *Waukegan* . . . . . Author V.3
Clinton, Hillary Rodham – *Chicago* . . Apr 93
Crawford, Cindy – *De Kalb* . . . . Apr 93
Crichton, Michael – *Chicago*. . . . Author V.5
Cushman, Karen – *Chicago* . . . . Author V.5
Garth, Jennie – *Urbana* . . . . Apr 96
Ford, Harrison – *Chicago* . . . . Sep 97
Hansberry, Lorraine – *Chicago*. . Author V.5
Joyner-Kersee, Jackie – *East St. Louis*. . . . . Oct 92
Margulis, Lynn – *Chicago*. . . . . Sep 96

McCully, Emily Arnold – *Galesburg* . . . Jul 92
Silverstein, Shel – *Chicago* . . . Author V.3
Siskel, Gene – *Chicago* . . . Sep 99
Watson, James D. – *Chicago* . . . Science V.1
Wrede, Patricia C. – *Chicago* . . . Author V.7

Indiana
Bird, Larry – *West Baden* . . . Jan 92
Davis, Jim – *Marion* . . . Author V.1
Letterman, David – *Indianapolis* . . . Jan 95
Naylor, Phyllis Reynolds – *Anderson* Apr 93
Pauley, Jane – *Indianapolis* . . . Oct 92
Peet, Bill – *Grandview* . . . Author V.4
Vonnegut, Kurt – *Indianapolis* . . . Author V.1

Iowa
Leopold, Aldo – *Burlington* . . . WorLdr V.3
Warner, Kurt – *Burlington* . . . Sport V.4

Iraq
Hussein, Saddam – *al-Auja* . . . Jul 92

Ireland, Northern
Lewis, C. S. – *Belfast* . . . Author V.3

Ireland, Republic of
Flannery, Sarah – *Blarney, County Cork* . . . Science V.5
Robinson, Mary – *Ballina* . . . Sep 93

Israel
Perlman, Itzhak – *Tel Aviv* . . . Jan 95
Portman, Natalie – *Jerusalem* . . . Sep 99
Rabin, Yitzhak – *Jerusalem* . . . Oct 92

Italy
Andretti, Mario – *Montona* . . . Sep 94
Krim, Mathilde – *Como* . . . Science V.1
Levi-Montalcini, Rita – *Turin* . . . Science V.1

Jamaica
Ashley, Maurice – *St. Andrew* . . . Sep 99
Bailey, Donovan – *Manchester* . . . Sport V.2
Denton, Sandi – *Kingston* . . . Apr 95
Ewing, Patrick – *Kingston* . . . Jan 95
Maxwell, Jody-Anne – *St. Andrew* . . . Sep 98

Japan
Miyamoto, Shigeru – *Sonobe* . . . Science V.5
Morita, Akio – *Kasugaya* . . . Science V.4
Suzuki, Shinichi – *Nagoya* . . . Sep 98
Uchida, Mitsuko – *Tokyo* . . . Apr 99

Jordan
Hussein, King – *Amman* . . . Apr 99

Kansas
Alley, Kirstie – *Wichita* . . . Jul 92
Ballard, Robert – *Wichita* . . . Science V.4
Brooks, Gwendolyn – *Topeka* . . . Author V.3
Dole, Bob – *Russell* . . . Jan 96
Parks, Gordon – *Fort Scott* . . . Artist V.1
Patrick, Ruth . . . Science V.3
Probst, Jeff – *Wichita* . . . Jan 01
Sanders, Barry – *Wichita* . . . Sep 95

Kentucky
Ali, Muhammad – *Louisville* . . . Sport V.2
Littrell, Brian – *Lexington* . . . Jan 00
Monroe, Bill – *Rosine* . . . Sep 97
Morgan, Garrett – *Paris* . . . Science V.2
Richardson, Kevin – *Lexington* . . . Jan 00

Kenya
Leakey, Louis – *Nairobi* . . . Science V.1
Kenyatta, Jomo – *Ngenda* . . . WorLdr V.2
Maathai, Wangari – *Nyeri* . . . WorLdr V.1
Ndeti, Cosmas – *Machakos* . . . Sep 95

Liberia
Tubman, William V. S. – *Harper City* . . . WorLdr V.2

Libya
Qaddafi, Muammar . . . Apr 97

Louisiana
Dumars, Joe – *Natchitoches* . . . Sport V.3
Gumbel, Bryant – *New Orleans* . . . Apr 97
Manning, Peyton – *New Orleans* . . . Sep 00
Marsalis, Wynton – *New Orleans* . . . Apr 92
Rice, Anne – *New Orleans* . . . Author V.3
Roberts, Cokie – *New Orleans* . . . Apr 95
Spears, Britney – *Kentwood* . . . Jan 01
Stewart, Kordell – *Marrero* . . . Sep 98

Macedonia
Teresa, Mother – *Skopje* . . . Apr 98

Maine
King, Stephen – *Portland* . . . Author V.1

Malawi
Banda, Hastings Kamuzu – *Chiwengo, Nyasaland* . . . WorLdr V.2

Maryland
Atwater-Rhodes, Amelia – *Silver Spring* . . . Author V.8
Hesse, Karen – *Baltimore* . . . Author V.5
Marshall, Thurgood – *Baltimore* . . . Jan 92
Ripken, Cal, Jr. – *Havre de Grace* . . . Sport V.1

Massachusetts
Bush, George – *Milton* . . . Jan 92
Butcher, Susan – *Cambridge* . . . Sport V.1
Cormier, Robert – *Leominister* . . . Author V.1
Fanning, Shawn – *Brockton* . . . Science V.5
Gilbert, Walter – *Cambridge* . . . Science V.2
Grandin, Temple – *Boston* . . . Science V.3

Guey, Wendy – *Boston* .... Sep 96
Guy, Jasmine – *Boston* .... Sep 93
Kerrigan, Nancy – *Woburn* .... Apr 94
Krakauer, Jon – *Brookline* ...... Author V.6
Pine, Elizabeth Michele – *Boston* .... Jan 94
Scarry, Richard – *Boston* .... Sep 94
Seuss, Dr. – *Springfield* .... Jan 92
Speare, Elizabeth George – *Melrose* . Sep 95
Thompson, Jenny – *Georgetown* .. Sport V.5
Voigt, Cynthia – *Boston* .... Oct 92
Walters, Barbara – *Boston* .... Sep 94

Mexico
Rivera, Diego – *Guanajuato* ...... Artist V.1

Michigan
Applegate, K.A. .... Jan 00
Askins, Renee .... WorLdr V.1
Carson, Ben – *Detroit* .... Science V.4
Curtis, Christopher Paul – *Flint* Author V.4
Galeczka, Chris – *Sterling Heights* ... Apr 96
Johnson, Magic – *Lansing* .... Apr 92
Kiraly, Karch – *Jackson* .... Sport V.4
Krone, Julie – *Benton Harbor* .... Jan 95
Lalas, Alexi – *Royal Oak* .... Sep 94
Riley, Dawn – *Detroit* .... Sport V.4
Shabazz, Betty – *Detroit* .... Apr 98
Van Allsburg, Chris – *Grand Rapids* . . Apr 92
Ward, Lloyd D. – *Romulus* .... Jan 01
Williams, Serena – *Saginaw* ..... Sport V.4
Winans, CeCe – *Detroit* .... Apr 00

Minnesota
Burger, Warren – *St. Paul* .... Sep 95
Douglas, Marjory Stoneman
– *Minneapolis* .... WorLdr V.1
Madden, John – *Austin* .... Sep 97
Mars, Forrest, Sr. – *Minneapolis* Science V.4
Murie, Olaus J. .... WorLdr V.1
Paulsen, Gary – *Minneapolis* ... Author V.1
Ryder, Winona – *Winona* .... Jan 93
Schulz, Charles – *Minneapolis* .. Author V.2
Scurry, Briana – *Minneapolis* .... Jan 00
Ventura, Jesse – *Minneapolis* .... Apr 99
Winfield, Dave – *St. Paul* .... Jan 93

Mississippi
Bass, Lance – *Clinton* .... Jan 01
Brandy – *McComb* .... Apr 96
Favre, Brett – *Gulfport* .... Sport V.2
Jones, James Earl – *Arkabutla*
Township .... Jan 95
McCarty, Oseola – *Wayne County* ... Jan 99
Payton, Walter – *Columbia* .... Jan 00
Rice, Jerry – *Crawford* .... Apr 93
Rimes, LeAnn – *Jackson* .... Jan 98
Taylor, Mildred D. – *Jackson* .... Author V.1
Winfrey, Oprah – *Kosciusko* .... Apr 92
Wright, Richard – *Natchez* ..... Author V.5

Missouri
Angelou, Maya – *St. Louis* .... Apr 93
Champagne, Larry III – *St. Louis* .... Apr 96
Goodman, John – *Affton* .... Sep 95
Heinlein, Robert – *Butler* ...... Author V.4
Hughes, Langston – *Joplin* ..... Author V.7
Lester, Julius – *St. Louis* .... Author V.7
Limbaugh, Rush – *Cape Girardeau* .. Sep 95
Miller, Shannon – *Rolla* .... Sep 94
Nye, Naomi Shihab – *St. Louis* .. Author V.8

Montana
Carvey, Dana – *Missoula* .... Jan 93
Horner, Jack – *Shelby* .... Science V.1
Lowe, Alex – *Missoula* .... Sport V.4

Morocco
Hassan II – *Rabat* .... WorLdr V.2

Myanmar
see Burma

Nevada
Agassi, Andre – *Las Vegas* .... Jul 92

New Jersey
Blume, Judy .... Jan 92
Carpenter, Mary Chapin
– *Princeton* .... Sep 94
Earle, Sylvia – *Gibbstown* ...... Science V.1
Glover, Savion – *Newark* .... Apr 99
Gwaltney, John Langston –
Orange .... Science V.3
Hill, Lauryn – *South Orange* .... Sep 99
Houston, Whitney – *Newark* .... Sep 94
Ice-T – *Newark* .... Apr 93
Jeter, Derek – *Pequannock* .... Sport V.4
Lawrence, Jacob – *Atlantic City* .. Artist V.1
Love, Susan – *Long Branch* .... Science V.3
Martin, Ann M. – *Princeton* .... Jan 92
Muniz, Frankie – *Ridgewood* .... Jan 01
O'Neal, Shaquille – *Newark* .... Sep 93
Pinsky, Robert – *Long Branch* .. Author V.7
Queen Latifah – *Newark* .... Apr 92
Rodman, Dennis – *Trenton* .... Apr 96
Schwarzkopf, H. Norman – *Trenton* . . Jan 92
Sinatra, Frank – *Hoboken* .... Jan 99
Thomas, Dave – *Atlantic City* ...... Apr 96

New Mexico
Foreman, Dave – *Albuquerque* ... WorLdr V.1

New York State
Abdul-Jabbar, Kareem – *New York City* . . . . Sport V.1
Abzug, Bella – *Bronx* . . . . Sep 98
Aguilera, Christina – *Staten Island* . . Apr 00
Avi – *New York City* . . . . Jan 93
Baldwin, James – *New York City* . . . . Author V.2
Blair, Bonnie – *Cornwall* . . . . Apr 94
Bourke-White, Margaret – *New York City* . . . . Artist V.1
Brody, Jane – *Brooklyn* . . . . Science V.2
Burke, Chris – *New York City* . . . . Sep 93
Burns, Ken – *Brooklyn* . . . . Jan 95
Bush, Barbara – *New York City* . . . . . . Jan 92
Calderone, Mary S. – *New York City* . . . . Science V.3
Carey, Mariah – *New York City* . . . . . Apr 96
Carle, Eric – *Syracuse* . . . . Author V.1
Carter, Nick – *Jamestown* . . . . Jan 00
Cohen, Adam Ezra – *New York City* Apr 97
Collins, Eileen – *Elmira* . . . . Science V.4
Combs, Sean (Puff Daddy) – *New York City* . . . . Apr 98
Cooney, Barbara – *Brooklyn* . . . . Author V.8
Cooney, Caroline B. – *Geneva* . . . Author V.4
Cronin, John – *Yonkers* . . . . WorLdr V.3
Culkin, Macaulay – *New York City* . . Sep 93
Danes, Claire – *New York City* . . . . . . Sep 97
de Mille, Agnes – *New York City* . . . . Jan 95
Duchovny, David – *New York City* . . Apr 96
Farrakhan, Louis – *Bronx* . . . . Jan 97
Fatone, Joey – *Brooklyn* . . . . Jan 01
Frankenthaler, Helen – *New York City* . . . . Artist V.1
Gellar, Sarah Michelle – *New York City* . . . . Jan 99
Giff, Patricia Reilly – *Queens* . . . . Author V.7
Ginsburg, Ruth Bader – *Brooklyn* . . . . Jan 94
Goldberg, Whoopi – *New York City* . . . . Apr 94
Gould, Stephen Jay – *New York City* . . . . Science V.2
Haley, Alex – *Ithaca* . . . . Apr 92
Hart, Melissa Joan – *Smithtown* . . . . . Jan 94
Healy, Bernadine – *Queens* . . . . Science V.1
Holdsclaw, Chamique – *Queens* . . . . . Sep 00
Hopper, Grace Murray – *New York City* . . . . Science V.5
James, Cheryl – *New York City* . . . . . Apr 95
Jordan, Michael – *Brooklyn* . . . . Jan 92
Kerr, M.E. – *Auburn* . . . . Author V.1
Konigsburg, E.L. – *New York City* . . . . Author V.3
Kurzweil, Raymond – *New York City* . . . . Science V.2
Lee, Stan – *New York City* . . . . . Author V.7
Lemelson, Jerome – *Staten Island* . . . . Science V.3
L'Engle, Madeleine – *New York City* . . Jan 92
Leno, Jay – *New Rochelle* . . . . Jul 92
Lewis, Shari – *New York City* . . . . Jan 99
Lowman, Meg – *Elmira* . . . . Science V.4
Mittermeier, Russell A. – *New York City* . . . . WorLdr V.1
Moses, Grandma – *Greenwich* . . . Artist V.1
Moss, Cynthia – *Ossining* . . . . . WorLdr V.3
O'Donnell, Rosie – *Commack* . . . . . . Apr 97
Oppenheimer, J. Robert – *New York City* . . . . Science V.1
Pascal, Francine – *New York City* . . . . Author V.6
Peterson, Roger Tory – *Jamestown* . . . . WorLdr V.1
Pike, Christopher – *Brooklyn* . . . . Sep 96
Powell, Colin – *New York City* . . . . . . Jan 92
Prelutsky, Jack – *Brooklyn* . . . . . . Author V.2
Reeve, Christopher – *Manhattan* . . . . Jan 97
Rinaldi, Ann – *New York City* . . . Author V.8
Ringgold, Faith – *New York City* . Author V.2
Rockwell, Norman – *New York City* . . . . Artist V.1
Roper, Dee Dee – *New York City* . . . . Apr 95
Sachar, Louis – *East Meadow* . . . Author V.6
Sagan, Carl – *Brooklyn* . . . . Science V.1
Salinger, J.D. – *New York City* . . Author V.2
Salk, Jonas – *New York City* . . . . Jan 94
Sealfon, Rebecca – *New York City* . . . Sep 97
Seinfeld, Jerry – *Brooklyn* . . . . Oct 92
Sendak, Maurice – *Brooklyn* . . . . Author V.2
Shakur, Tupac – *Bronx* . . . . Apr 97
Strasser, Todd – *New York City* . . Author V.7
Washington, Denzel – *Mount Vernon* . . Jan 93
Wayans, Keenen Ivory – *New York City* . . . . Jan 93
White, E.B. – *Mount Vernon* . . . . Author V.1
Williams, Garth – *New York City* . Author V.2
Yolen, Jane – *New York City* . . . . Author V.7
Zindel, Paul – *Staten Island* . . . . . Author V.1
New Zealand
Hillary, Sir Edmund – *Auckland* . . . . Sep 96

Nigeria
Olajuwon, Hakeem – *Lagos* . . . . Sep 95
Saro-Wiwa, Ken – *Bori, Rivers State* . . . . WorLdr V.1
North Carolina
Bearden, Romare – *Charlotte* . . . . . Artist V.1
Byars, Betsy – *Charlotte* . . . . . . Author V.4
Chavis, Benjamin – *Oxford* . . . . Jan 94
Delany, Bessie – *Raleigh* . . . . Sep 99
Dole, Elizabeth Hanford – *Salisbury* . . Jul 92
Petty, Richard – *Level Cross* . . . . . . Sport V.2
Williamson, Kevin – *New Bern* . . Author V.6
Norway
Brundtland, Gro Harlem – *Baerum* . . . . Science V.3
Ohio
Anderson, Terry – *Lorain* . . . . Apr 92
Battle, Kathleen – *Portsmouth* . . . . Jan 93
Berry, Halle – *Cleveland* . . . . Jan 95
Creech, Sharon – *Mayfield Heights* . . . . Author V.5
Dove, Rita – *Akron* . . . . Jan 94
Draper, Sharon – *Cleveland* . . . . Apr 99
Dunbar, Paul Laurence – *Dayton* . . . . Author V.8
Glenn, John – *Cambridge* . . . . Jan 99
Guisewite, Cathy – *Dayton* . . . . Sep 93
Hamilton, Virginia – *Yellow Springs* . . . . Author V.1
Hampton, David . . . . Apr 99
Harbaugh, Jim – *Toledo* . . . . Sport V.3
Holmes, Katie – *Toledo* . . . . Jan 00
Lin, Maya – *Athens* . . . . Sep 97
Lovell, Jim – *Cleveland* . . . . Jan 96
Morrison, Toni – *Lorain* . . . . Jan 94
Nicklaus, Jack – *Columbus* . . . . Sport V.2
Perry, Luke – *Mansfield* . . . . Jan 92
Rose, Pete – *Cincinnati* . . . . Jan 92
Shula, Don – *Grand River* . . . . Apr 96
Spielberg, Steven – *Cincinnati* . . . . . . Jan 94
Steinem, Gloria – *Toledo* . . . . Oct 92
Stine, R.L. – *Columbus* . . . . Apr 94
Tompkins, Douglas – *Conneaut* . . . . WorLdr V.3
Woodson, Jacqueline – *Columbus* . . . . Author V.7
Oklahoma
Brooks, Garth – *Tulsa* . . . . Oct 92
Duke, David – *Tulsa* . . . . Apr 92
Ellison, Ralph – *Oklahoma City* . . Author V.3
Hanson, Ike – *Tulsa* . . . . Jan 98
Hanson, Taylor – *Tulsa* . . . . Jan 98
Hanson, Zac – *Tulsa* . . . . Jan 98
Hill, Anita – *Morris* . . . . Jan 93
Hinton, S.E. – *Tulsa* . . . . Author V.1
Mankiller, Wilma – *Tahlequah* . . . . . . Apr 94
Mantle, Mickey – *Spavinaw* . . . . Jan 96
McEntire, Reba – *McAlester* . . . . Sep 95
Pitt, Brad – *Shawnee* . . . . Sep 98
Oregon
Cleary, Beverly – *McMinnville* . . . . . . Apr 94
Engelbart, Douglas – *Portland* . . Science V.5
Groening, Matt – *Portland* . . . . Jan 92
Harding, Tonya – *Portland* . . . . Sep 94
Hooper, Geoff – *Salem* . . . . Jan 94
Pauling, Linus – *Portland* . . . . Jan 95
Phoenix, River – *Madras* . . . . Apr 94
Schroeder, Pat – *Portland* . . . . Jan 97
Pakistan
Bhutto, Benazir – *Karachi* . . . . Apr 95
Masih, Iqbal . . . . Jan 96
Palestine
Perlman, Itzhak – *Tel Aviv* . . . . Jan 95
Rabin, Yitzhak – *Jerusalem* . . . . Oct 92
Panama
McCain, John – *Panama Canal Zone* . . . . Apr 00
Pennsylvania
Abbey, Edward – *Indiana* . . . . . WorLdr V.1
Alexander, Lloyd – *Philadelphia* . Author V.6
Anderson, Marian – *Philadelphia* . . . . Jan 94
Berenstain, Jan – *Philadelphia* . . Author V.2
Berenstain, Stan – *Philadelphia* . Author V.2
Bradley, Ed – *Philadelphia* . . . . Apr 94
Bryant, Kobe – *Philadelphia* . . . . Apr 99
Calder, Alexander – *Lawnton* . . . . Artist V.1
Carson, Rachel – *Springdale* . . . WorLdr V.1
Chamberlain, Wilt – *Philadelphia* . . Sport V.4
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1	Salinger, J.D.	1919
2	Asimov, Isaac	1920
4	Naylor, Phyllis Reynolds	1933
	Shula, Don	1930
7	Hurston, Zora Neale	?1891
	Rodriguez, Eloy	1947
8	Hawking, Stephen W.	1942
9	McLean, A.J.	1978
	Menchu, Rigoberta	1959
	Nixon, Richard	1913
11	Leopold, Aldo	1887
12	Amanpour, Christiane	1958
	Lasseter, John	?1957
	Limbaugh, Rush	1951
14	Lucid, Shannon	1943
15	Werbach, Adam	1973
16	Fossey, Dian	1932
17	Carrey, Jim	1962
	Cormier, Robert	1925
	Jones, James Earl	1931
	Lewis, Shari	?1934
18	Ali, Muhammad	1942
	Messier, Mark	1961
19	Askins, Renee	1959
	Johnson, John	1918
21	Domingo, Placido	1941
	Nicklaus, Jack	1940
	Olajuwon, Hakeem	1963
22	Chavis, Benjamin	1948
	Ward, Lloyd D.	1949
23	Thiessen, Tiffani-Amber	1974
24	Haddock, Doris (Granny D)	1910
25	Alley, Kirstie	1955
26	Carter, Vince	1977
	Morita, Akio	1921
	Siskel, Gene	1946
27	Lester, Julius	1939
28	Carter, Nick	1980
	Fatone, Joey	1977
	Gretzky, Wayne	1961
29	Abbey, Edward	1927
	Gilbert, Sara	1975
	Hasek, Dominik	1965
	Peet, Bill	1915
	Winfrey, Oprah	1954
30	Alexander, Lloyd	1924
	Engelbart, Douglas	1925
31	Flannery, Sarah	1982
	Robinson, Jackie	1919
	Ryan, Nolan	1947
	Timberlake, Justin	1981

February		Year
1	Hughes, Langston	1902
	Spinelli, Jerry	1941
	Yeltsin, Boris	1931
3	Nixon, Joan Lowery	1927
	Rockwell, Norman	1894
4	Parks, Rosa	1913
5	Aaron, Hank	1934
6	Leakey, Mary	1913
	Rosa, Emily	1987
	Zmeskal, Kim	1976
7	Brooks, Garth	1962
	Wang, An	1920
	Wilder, Laura Ingalls	1867
8	Grisham, John	1955
9	Love, Susan	1948
10	Konigsburg, E.L.	1930
	Norman, Greg	1955
11	Aniston, Jennifer	1969
	Brandy	1979
	Yolen, Jane	1939
12	Blume, Judy	1938
	Kurzweil, Raymond	1948
	Woodson, Jacqueline	?1964
13	Moss, Randy	1977
15	Groening, Matt	1954
	Jagr, Jaromir	1972
	Van Dyken, Amy	1973
16	Freeman, Cathy	1973

February (continued)		Year
17	Anderson, Marian	1897
	Hargreaves, Alison	1962
	Jordan, Michael	1963
18	Morrison, Toni	1931
20	Adams, Ansel	1902
	Barkley, Charles	1963
	Cobain, Kurt	1967
	Crawford, Cindy	1966
	Hernandez, Livan	1975
	Littrell, Brian	1975
21	Carpenter, Mary Chapin	1958
	Hewitt, Jennifer Love	1979
	Jordan, Barbara	1936
	Mugabe, Robert	1924
22	Barrymore, Drew	1975
	Fernandez, Lisa	1971
24	Jobs, Steven	1955
	Vernon, Mike	1963
	Whitestone, Heather	1973
25	Voigt, Cynthia	1942
26	Thompson, Jenny	1973
27	Clinton, Chelsea	1980
	Hunter-Gault, Charlayne	1942
28	Andretti, Mario	1940
	Pauling, Linus	1901

March		Year
1	Ellison, Ralph Waldo	1914
	Murie, Olaus J.	1889
	Rabin, Yitzhak	1922
	Zamora, Pedro	1972
2	Gorbachev, Mikhail	1931
	Satcher, David	1941
	Seuss, Dr.	1904
3	Hooper, Geoff	1979
	Joyner-Kersee, Jackie	1962
	MacLachlan, Patricia	1938
4	Morgan, Garrett	1877
5	Margulis, Lynn	1938
6	Ashley, Maurice	1966
7	McCarty, Oseola	1908
8	Prinze, Freddie Jr.	1976
10	Guy, Jasmine	1964
	Miller, Shannon	1977
	Wolf, Hazel	1898
12	Hamilton, Virginia	1936
	Nye, Naomi Shihab	1952
13	Van Meter, Vicki	1982
14	Dayne, Ron	1977
	Hanson, Taylor	1983
	Williamson, Kevin	1965
15	Ginsburg, Ruth Bader	1933
16	O'Neal, Shaquille	1972
17	Hamm, Mia	1972
	Nureyev, Rudolf	1938
18	Blair, Bonnie	1964
	de Klerk, F.W.	1936
	Queen Latifah	1970
19	Blanchard, Rachel	1976
20	Lee, Spike	1957
	Lowry, Lois	1937
	Sachar, Louis	1954
21	Gilbert, Walter	1932
	O'Donnell, Rosie	1962
22	Shatner, William	1931
24	Manning, Peyton	1976
25	Lovell, Jim	1928
	Steinem, Gloria	1934
	Swoopes, Sheryl	1971
26	Allen, Marcus	1960
	Erdös, Paul	1913
	O'Connor, Sandra Day	1930
	Stockton, John	1962
27	Carey, Mariah	1970
	Wrede, Patricia C.	1953
28	James, Cheryl	
	McEntire, Reba	1955
	Tompkins, Douglas	1943
30	Dion, Celine	1968
	Hammer	1933
31	Chavez, Cesar	1927
	Gore, Al	1948
	Howe, Gordie	1928

April		Year
1	Maathai, Wangari	1940
2	Carvey, Dana	1955
3	Garth, Jennie	1972
	Goodall, Jane	1934
	Street, Picabo	1971
4	Angelou, Maya	1928
5	Powell, Colin	1937
6	Watson, James D.	1928
7	Dougals, Marjory Stoneman	1890
8	Annan, Kofi	1938
10	Madden, John	1936
12	Cleary, Beverly	1916
	Danes, Claire	1979

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	Doherty, Shannen	1971
	Letterman, David	1947
	Soto, Gary	1952
13	Brandis, Jonathan	1976
	Henry, Marguerite	1902
14	Gellar, Sarah Michelle	1977
	Maddux, Greg	1966
	Rose, Pete	1941
15	Martin, Bernard	1954
16	Abdul-Jabbar, Kareem	1947
	Atwater-Rhodes, Amelia	1984
	Selena	1971
	Williams, Garth	1912
17	Champagne, Larry III	1985
18	Hart, Melissa Joan	1976
20	Brundtland, Gro Harlem	1939
21	Muir, John	1838
22	Levi-Montalcini, Rita	1909
	Oppenheimer, J. Robert	1904
25	Fitzgerald, Ella	1917
26	Giff, Patricia Reilly	1935
	Pei, I.M.	1917
27	Wilson, August	1945
28	Baker, James	1930
	Duncan, Lois	1934
	Hussein, Saddam	1937
	Kaunda, Kenneth	1924
	Leno, Jay	1950
29	Agassi, Andre	1970
	Seinfeld, Jerry	1954

May		Year
2	Spock, Benjamin	1903
4	Bass, Lance	1979
5	Lionni, Leo	1910
	Maxwell, Jody-Anne	1986
	Strasser, Todd	1950
7	Land, Edwin	1909
8	Attenborough, David	1926
9	Bergen, Candice	1946
	Yzerman, Steve	1965
10	Cooney, Caroline B.	1947
	Curtis, Christopher Paul	1953
	Galdikas, Biruté	1946
	Jamison, Judith	1944
11	Farrakhan, Louis	1933
12	Mowat, Farley	1921
13	Pascal, Francine	1938
	Rodman, Dennis	1961
14	Lucas, George	1944
	Smith, Emmitt	1969
15	Albright, Madeleine	1937
	Johns, Jasper	1930
	Zindel, Paul	1936
17	Paulsen, Gary	1939
18	John Paul II	1920
19	Brody, Jane	1941
	Hansberry, Lorraine	1930
21	Robinson, Mary	1944
23	Bardeen, John	1908
	Jewel	1974
	O'Dell, Scott	1898
24	Dumars, Joe	1963
26	Hill, Lauryn	1975
	Ride, Sally	1951
27	Carson, Rachel	1907
	Kerr, M.E.	1927
28	Johnston, Lynn	1947
	Shabazz, Betty	1936
30	Cohen, Adam Ezra	1979

June		Year
1	Lalas, Alexi	1970
	Morissette, Alanis	1974
4	Kistler, Darci	1964
	Nelson, Gaylord	1916
5	Scarry, Richard	1919
6	Rylant, Cynthia	1954
7	Brooks, Gwendolyn	1917
	Oleynik, Larisa	1981
8	Bush, Barbara	1925
	Davenport, Lindsay	1976
	Edelman, Marian Wright	1939
	Wayans, Keenen Ivory	1958
	Wright, Frank Lloyd	1869
9	Portman, Natalie	1981
10	Frank, Anne	1929
	Lipinski, Tara	1982
	Sendak, Maurice	1928
11	Cousteau, Jacques	1910
	Montana, Joe	1956
12	Bush, George	1924
13	Allen, Tim	1953
	Alvarez, Luis W.	1911
	Christo	1935
14	Bourke-White, Margaret	1904
	Graf, Steffi	1969
	Summitt, Pat	1952
	Yep, Laurence	1948

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15	Horner, Jack	1946
	Jacques, Brian	1939
16	McClintock, Barbara	1902
	Shakur, Tupac	1971
17	Gingrich, Newt	1943
	Jansen, Dan	1965
	Williams, Venus	1980
18	Johnson, Angela	1961
	Morris, Nathan	1971
	Van Allsburg, Chris	1949
19	Abdul, Paula	1962
	Aung San Suu Kyi	1945
20	Goodman, John	1952
21	Bhutto, Benazir	1953
	Breathed, Berke	1957
22	Bradley, Ed	1941
	Daly, Carson	1973
	Warner, Kurt	1971
23	Rudolph, Wilma	1940
	Thomas, Clarence	1948
25	Carle, Eric	1929
	Gibbs, Lois	1951
26	Harris, Bernard	1956
	Jeter, Derek	1974
	LeMond, Greg	1961
27	Babbitt, Bruce	1938
	Dunbar, Paul Laurence	1872
	Perot, H. Ross	1930
28	Elway, John	1960
30	Ballard, Robert	1942

July		Year
1	Brower, David	1912
	Calderone, Mary S.	1904
	Diana, Princess of Wales	1961
	Duke, David	1950
	Lewis, Carl	1961
	McCully, Emily Arnold	1939
2	Bethe, Hans A.	1906
	George, Jean Craighead	1919
	Marshall, Thurgood	1908
	Petty, Richard	1937
	Thomas, Dave	1932
5	Watterson, Bill	1958
6	Bush, George W.	1946
	Dalai Lama	1935
	Dumitriu, Ioana	1976
7	Chagall, Marc	1887
	Heinlein, Robert	1907
	Kwan, Michelle	1980
	Stachowski, Richie	1985
8	Hardaway, Anfernee "Penny"	1971
	Sealfon, Rebecca	1983
9	Farmer, Nancy	1941
	Hanks, Tom	1956
	Hassan II	1929
	Krim, Mathilde	1926
	Sacks, Oliver	1933
10	Ashe, Arthur	1943
	Boulmerka, Hassiba	1969
11	Cisneros, Henry	1947
	White, E.B.	1899
12	Cosby, Bill	1937
	Johnson, Johanna	1983
	Yamaguchi, Kristi	1972
13	Ford, Harrison	1942
	Stewart, Patrick	1940
15	Aristide, Jean-Bertrand	1953
	Ventura, Jesse	1951
16	Johnson, Jimmy	1943
	Sanders, Barry	1968
18	Glenn, John	1921
	Lemelson, Jerome	1923
	Mandela, Nelson	1918
19	Tarvin, Herbert	1985
20	Hillary, Sir Edmund	1919
21	Chastain, Brandi	1968
	Reno, Janet	1938
	Riley, Dawn	1964
	Williams, Robin	1952
22	Calder, Alexander	1898
	Dole, Bob	1923
	Hinton, S.E.	1948
23	Haile Selassie	1892
24	Abzug, Bella	1920
	Krone, Julie	1963
	Moss, Cynthia	1940
	Wilson, Mara	1987
25	Payton, Walter	1954
26	Berenstain, Jan	1923
28	Davis, Jim	1945
	Pottter, Beatrix	1866
29	Burns, Ken	1953
	Creech, Sharon	1945
	Dole, Elizabeth Hanford	1936
	Jennings, Peter	1938
	Morris, Wanya	1973
30	Hill, Anita	1956
	Moore, Henry	1898
	Schroeder, Pat	1940

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31	Cronin, John	1950
	Reid Banks, Lynne	1929
	Rowling, J. K.	1965

August		Year
1	Brown, Ron	1941
	Coolio	1963
	Garcia, Jerry	1942
2	Baldwin, James	1924
	Healy, Bernadine	1944
3	Roper, Dee Dee	
	Savimbi, Jonas	1934
4	Gordon, Jeff	1971
5	Ewing, Patrick	1962
	Jackson, Shirley Ann	1946
6	Cooney, Barbara	1917
	Robinson, David	1965
	Warhol, Andy	?1928
7	Byars, Betsy	1928
	Duchovny, David	1960
	Leakey, Louis	1903
8	Boyd, Candy Dawson	1946
	Chasez, JC	1976
9	Anderson, Gillian	1968
	Holdsclaw, Chamique	1977
	Houston, Whitney	1963
	McKissack, Patricia C.	1944
	Sanders, Deion	1967
	Travers, P.L.	?1899
11	Haley, Alex	1921
	Hogan, Hulk	1953
	Wozniak, Steve	1950
12	Martin, Ann M.	1955
	McKissack, Fredrick L.	1939
	Myers, Walter Dean	1937
	Sampras, Pete	1971
13	Battle, Kathleen	1948
	Castro, Fidel	1927
14	Berry, Halle	?1967
	Johnson, Magic	1959
	Larson, Gary	1950
15	Affleck, Benjamin	1972
	Ellerbee, Linda	1944
16	Fu Mingxia	1978
	Thampy, George	1987
18	Danziger, Paula	1944
	Murie, Margaret	1902
19	Clinton, Bill	1946
	Soren, Tabitha	1967
20	Chung, Connie	1946
	Milosevic, Slobodan	1941
21	Chamberlain, Wilt	1936
	Draper, Sharon	1952
	Toro, Natalia	1984
22	Bradbury, Ray	1920
	Dorough, Howie	1973
	Schwarzkopf, H. Norman	1934
23	Bryant, Kobe	1978
	Novello, Antonia	1944
	Phoenix, River	1970
24	Arafat, Yasir	1929
	Dai Qing	1941
	Ripken, Cal, Jr.	1960
25	Case, Steve	1958
26	Burke, Christopher	1965
	Culkin, Macaulay	1980
	Sabin, Albert	1906
	Teresa, Mother	1910
	Tuttle, Merlin	1941
27	Nechita, Alexandra	1985
	Rinaldi, Ann	1934
28	Dove, Rita	1952
	Evans, Janet	1971
	Peterson, Roger Tory	1908
	Priestley, Jason	1969
	Rimes, LeAnn	1982
	Twain, Shania	1965
29	Grandin, Temple	1947
	Hesse, Karen	1952
	McCain, John	1936
30	Earle, Sylvia	1935
31	Perlman, Itzhak	1945

September		Year
1	Estefan, Gloria	1958
	Smyers, Karen	1961
2	Bearden, Romare	?1912
	Galeczka, Chris	1981
3	Delany, Bessie	1891
4	Wright, Richard	1908
5	Guisewite, Cathy	1950
7	Lawrence, Jacob	1917
	Moses, Grandma	1860
	Pippig, Uta	1965
	Scurry, Briana	1971
8	Prelutsky, Jack	1940
	Thomas, Jonathan Taylor	1982
10	Gould, Stephen Jay	1941
13	Johnson, Michael	1967
	Monroe, Bill	1911
	Taylor, Mildred D.	1943

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14	Armstrong, William H.	1914
	Stanford, John	1938
15	dePaola, Tomie	1934
	Marino, Dan	1961
16	Dahl, Roald	1916
	Gates, Henry Louis, Jr.	1950
17	Burger, Warren	1907
18	Armstrong, Lance	1971
	Carson, Ben	1951
	de Mille, Agnes	1905
	Fields, Debbi	1956
19	Delany, Sadie	1889
21	Fielder, Cecil	1963
	King, Stephen	1947
	Nkrumah, Kwame	1909
22	Richardson, Dot	1961
23	Nevelson, Louise	1899
24	Ochoa, Severo	1905
25	Gwaltney, John Langston	1928
	Locklear, Heather	1961
	Lopez, Charlotte	1976
	Pippen, Scottie	1965
	Reeve, Christopher	1952
	Smith, Will	1968
	Walters, Barbara	1931
26	Mandela, Winnie	1934
	Stockman, Shawn	1972
	Williams, Serena	1981
27	Handford, Martin	1956
28	Cray, Seymour	1925
	Pak, Se Ri	1977
29	Berenstain, Stan	1923
	Guey, Wendy	1983
	Gumbel, Bryant	1948
30	Hingis, Martina	1980
	Moceanu, Dominique	1981

October		Year
1	Carter, Jimmy	1924
	McGwire, Mark	1963
2	Leibovitz, Annie	1949
3	Campbell, Neve	1973
	Herriot, James	1916
	Richardson, Kevin	1972
	Winfield, Dave	1951
4	Cushman, Karen	1941
	Rice, Anne	1941
5	Fitzhugh, Louise	1928
	Hill, Grant	1972
	Lemieux, Mario	1965
	Lin, Maya	1959
	Winslet, Kate	1975
6	Lobo, Rebecca	1973
7	Ma, Yo-Yo	1955
8	Jackson, Jesse	1941
	Ringgold, Faith	1930
	Stine, R.L.	1943
	Winans, CeCe	1964
9	Bryan, Zachery Ty	1981
	Senghor, Léopold Sédar	1906
10	Favre, Brett	1969
	Saro-Wiwa, Ken	1941
11	Perry, Luke	?1964
	Young, Steve	1961
12	Childress, Alice	?1920
	Jones, Marion	1975
	Ward, Charlie	1970
13	Carter, Chris	1956
	Kerrigan, Nancy	1969
	Rice, Jerry	1962
14	Daniel, Beth	1956
	Mobutu Sese Seko	1930
15	Iacocca, Lee A.	1924
16	Stewart, Kordell	1972
17	Jemison, Mae	1956
	Kirkpatrick, Chris	1971
18	Foreman, Dave	1946
	Marsalis, Wynton	1961
	Navratilova, Martina	1956
	Suzuki, Shinichi	1898
20	Kenyatta, Jomo	?1891
	Mantle, Mickey	1931
	Pinsky, Robert	1940
21	Gillespie, Dizzy	1956
	Le Guin, Ursula K.	1929
22	Hanson, Zac	1985
23	Crichton, Michael	1942
	Pelé	1940
25	Martinez, Pedro	1971
26	Clinton, Hillary Rodham	1947
27	Anderson, Terry	1947
28	Gates, Bill	1955
	Salk, Jonas	1914
29	Ryder, Winona	1971
31	Candy, John	1950
	Paterson, Katherine	1932
	Pauley, Jane	1950
	Tucker, Chris	1973

November		Year
2	lang, k.d.	1961
3	Arnold, Roseanne	1952
	Kiraly, Karch	1960
4	Combs, Sean (Puff Daddy)	1969
	Handler, Ruth	1916
8	Mittermeier, Russell A.	1949
9	Denton, Sandi	
	Sagan, Carl	1934
10	Bates, Daisy	?1914
11	DiCaprio, Leonardo	1974
	Vonnegut, Kurt	1922
12	Andrews, Ned	1980
	Blackmun, Harry	1908
	Harding, Tonya	1970
	Sosa, Sammy	1968
13	Goldberg, Whoopi	1949
14	Boutros-Ghali, Boutros	1922
	Hussein, King	1935
15	O'Keeffe, Georgia	1887
	Pinkwater, Daniel	1941
16	Baiul, Oksana	1977
	Miyamoto, Shigeru	1952
17	Fuentes, Daisy	1966
	Hanson, Ike	1980
18	Driscoll, Jean	1966
	Mankiller, Wilma	1945
19	Collins, Eileen	1956
	Devers, Gail	1966
	Glover, Savion	1973
	Strug, Kerri	1977
21	Aikman, Troy	1966
	Griffey, Ken, Jr.	1969
	Speare, Elizabeth George	1908
24	Ndeti, Cosmas	1971
25	Grant, Amy	1960
	Thomas, Lewis	1913
26	Patrick, Ruth	1907
	Pine, Elizabeth Michele	1975
	Schulz, Charles	1922
27	Nye, Bill	1955
	White, Jaleel	1977
29	L'Engle, Madeleine	1918
	Lewis, C. S.	1898
	Tubman, William V. S.	1895
30	Jackson, Bo	1962
	Parks, Gordon	1912

December		Year
2	Macaulay, David	1946
	Seles, Monica	1973
	Spears, Britney	1981
	Watson, Paul	1950
3	Filipovic, Zlata	1980
5	Muniz, Frankie	1985
6	Risca, Viviana	1982
7	Bird, Larry	1956
8	Rivera, Diego	1886
9	Hopper, Grace Murray	1906
12	Bialik, Mayim	1975
	Frankenthaler, Helen	1928
	Sinatra, Frank	1915
13	Fedorov, Sergei	1969
14	Jackson, Shirley	1916
15	Aidid, Mohammed Farah	1934
	Mendes, Chico	1944
16	Bailey, Donovan	1967
	McCary, Michael	1971
	Mead, Margaret	1901
17	Kielburger, Craig	1982
18	Aguilera, Christina	1980
	Holmes, Katie	1978
	Pitt, Brad	1964
	Sanchez Vicario, Arantxa	1971
	Spielberg, Steven	1947
19	Morrison, Sam	1936
	Sapp, Warren	1972
	White, Reggie	1961
20	Uchida, Mitsuko	1948
21	Evert, Chris	1954
	Griffith Joyner, Florence	1959
	Webb, Karrie	1974
22	Pinkney, Jerry	1939
23	Avi	1937
	Harbaugh, Jim	1963
	Lowman, Meg	1953
24	Lowe, Alex	1958
	Martin, Ricky	1971
25	Sadat, Anwar	1918
26	Butcher, Susan	1954
27	Roberts, Cokie	1943
28	Lee, Stan	1922
	Washington, Denzel	1954
30	Woods, Tiger	1975

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